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AGRICULTURAL RESEARCH IN MAINE

Sixty-Sixth Annual Report of Progress
Year Ending June 30, 1950

THE MAINE AGRICULTURAL EXPERIMENT STATION

UNIVERSITY OF MAINE

ORONO, MAINE

Laboratory and Farmhouse at Blueberry Hill Farm, Jonesboro, Where
Much of the Blueberry Research Work is Conducted.



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AGRICULTURAL RESEARCH IN MAINE

FRED GRIFFEE, Director

G. F. Dow, Assistant Director

FOREWORD

Continued progress was made during the year in solving the many problems confronting Maine agriculture. The high lights of the findings and conclusions of the research staff in their studies of the problems of production, marketing, and better rural living are presented in this report. The varied scope of the research program is indicated in the preceding Table of Contents.

The effectiveness of the research program has been increased during the past year by several developments. An increase in funds was received from appropriations under the Research and Marketing Act of 1946, although these funds are still considerably less than originally authorized by law. More details as to income and expenses are given in the last pages of this report.

The new Plant Science Building provides much improved facilities for the research departments of Agronomy, Entomology, Forestry, Horticulture, and Plant Pathology; and brings together research, teaching and extension men under one roof permitting close cooperation and coordination of work.

Holmes Hall is being remodelled as rapidly as funds permit for laboratory space for additional food processing work and for use by the Chemistry Department and Administrative staff.

The apple storage at Highmoor Farm has been remodelled to provide facilities for studies of controlled temperature and atmosphere conditions on the storage life of apples. The dairy barn is being converted to use for general apple storage, and for grading and packaging operations in marketing studies.

Soil conservation experiments are being continued at a new location, on the Ashby Farm in Caribou, which has been leased for this purpose.

The success of the research program depends in large measure upon maintaining a competent staff of trained men. New members added to the staff during the past year include Dr. Frank W. Peikert from Michigan State College, who is head of the new department of Agricultural Engineering, Dr. Frank P. Eggert from Cornell University, who is head of the Department of Horticulture, Dr. Homer B. Metzger from Pennsylvania State College, who replaces Dr. H. A. Luke in carrying on the dairy marketing program, Mr. Ralph F. Evans, who was assis-

tant during the year in Animal Husbandry, and David J. Dubé and Judith M. Banton, who are assistants in the Chemistry Department. Resignations received during the year included Dr. H. A. Luke in Agricultural Economics, Dr. A. E. Prince in Agronomy, and M. G. Moore in Chemistry.

The broad program of research work that is being carried on is possible only because of strong industry support through the Potato Tax, Blueberry Tax, and Corn Tax. Special appreciation also is acknowledged for special grants of funds, for work on specific projects, from Bangor Hydro-Electric Co., Central Maine Power Co., C. M. Cox Co., Dept. of Sea and Shore Fisheries, Eastern States Farmers' Exchange, E. I. du Pont de Nemours Co., Fertilizer Industry Committee on Radioactive Tracer Elements, General Chemical Co., Kraft Foods Co., Maine Canners Association, Maine Public Service Co., Summers Fertilizer Co. through James E. Totman, and Tenn. Corporation.

Other industry groups actively cooperated in carrying on certain phases of the research program, including American Can Co., H. C. Baxter & Bro., Birds Eye-Snider Division of General Foods Corp., and Maine Institute of Potato Starch Manufacturers. The research program also was furthered by excellent cooperation given by a number of State and Federal agencies including other Northeast Agricultural Experiment Stations, Boston Milk Administrator's Office, the Maine Department of Agriculture, Maine Extension Service, and United States Department of Agriculture.

Acknowledgment also is made for the assistance given by a number of farmers and homemakers who cooperated in various ways in conducting research in connection with their own farms. Such cooperation makes possible a much more effective program in solving Maine's agricultural problems.

APPLES

APPLE BREEDING. R. M. Bailey. Research is in progress to locate better high quality winter apple varieties for Maine. Several selections from controlled crosses have been sufficiently promising in the preliminary trials to justify more detailed testing at Highmoor Farm. These have been budded and added to the variety test block. New crosses have been made and the seedlings are being subjected to a screening test for scab resistance before setting in the breeding block. Macoun has continued to be outstanding as a high quality dessert variety that retains its flavor after the McIntosh season.

HARDY STOCKS FOR APPLE ORCHARDS. M. T. Hilborn. Three new

hardy intermediate stocks have been added to the experimental plantings at Highmoor Farm making a total of 74 different kinds now under test. Of this total, 11 have been selected as showing enough promise as stocks to warrant further investigation. These have been propagated in larger numbers for orchard planting and later will be top-worked to the commercial varieties of apples.

EXPERIMENTAL APPLE ORCHARD ON HARDY STOCKS. F. P. Eggert. A total of 1000 apple seedlings have been purchased which will be used to develop a hardy stock orchard for experimental purposes. This will be used primarily as a long time fertilizer experiment involving the varieties of apples of importance in Maine. Several of these varieties are not included in the present demonstration orchard which was planted with standard nursery trees.

APPLE FERTILIZATION. F. P. Eggert, R. M. Bailey, M. F. Trevett. The use of a hay or straw mulch increased yields in 1949 an average of 51 per cent for McIntosh and 77 per cent for Northern Spy trees. Over the nine-year period, in which the experiment has run, mulching has increased the yield of McIntosh trees an average of about 50 bushels per acre, and has increased the yield of Northern Spy trees an average of about 68 bushels per acre.

Over the same period of nine years, the NK treatment has shown significantly higher yields on McIntosh than N alone or NPK. Manure treatment on McIntosh has consistently been a poor treatment although this may be due to the lateness of the application in the spring. For Northern Spy, manure has given the lowest yields, while complete fertilizer (NPK) has given the highest yields.

An experiment of a preliminary nature was begun to determine the effect of the various fertilizer treatments on color and keeping quality of the fruit. In 1949 the mulch treatment resulted in a reduction in color of both McIntosh and Northern Spy. However, the color reduction was in no case sufficient to lower the grade of fruit. The relative keeping quality of McIntosh, as determined by the use of the pressure tester, was not affected by fertilization. However, Northern Spy apples that were mulched had significantly poorer keeping quality than those that were unmulched. Manure treatment resulted in the best color on Northern Spy, while the nitrogen treatment resulted in the poorest color. Further work is planned to check more fully on the influence of these treatments on color development and storage quality.

The yield records on a young McIntosh orchard in Franklin County continue to show no differences in yield resulting from treatments.

FUNGICIDES FOR APPLE SCAB CONTROL. M. T. Hilborn, F. H. Lathrop. Two of the newer organic fungicides have shown sufficient

promise in the control of apple scab to justify a tentative recommendation to commercial orchardists. Four years' results show that Phygon, a naptho quinone, has been consistently good as a material for the control of early season scab infection. Spray injury may result if Phygon is used later in the season, particularly under high temperature conditions. As a result it is suggested that Phygon be used only in the pre-bloom applications.

Another material, Crag Fruit Fungicide 341C, a mixture of glyoxalidines, has shown considerable promise not only in satisfactorily controlling apple scab but also in aiding the natural control of European red mite. Since the critical period for the control of European red mite occurs after petal-fall it is suggested that Crag Fruit Fungicide 341C be used in the petal-fall and cover applications.

EUROPEAN RED MITE. F. H. Lathrop, M. T. Hilborn, B. E. Plummer, Jr., J. M. Banton. The severe drought and the hot weather that prevailed again during the summer of 1949, favored the development of European red mite. The thorough application of oil spray in the delayed dormant period, however, reduced the red mite population to such an extent that generally it was not necessary to apply additional treatment for red mites during the summer.

Observations and experiments in 1949 confirmed the results of previous years that mild sulphur sprays and dusts, applied through the post-bloom period for the control of apple scab, promoted the development of severe red-mite injury. The increased severity of the mite infestation following the late-season applications of sulphur, probably resulted from the destructive action of the sulphur upon many of the natural enemies of the red mites. Two materials, Crag Fruit Fungicide 341C and Arathane* used experimentally in 1948 and in 1949 for the control of both apple scab and European red mite, appeared promising for use in place of sulphur throughout the post-bloom period.

In one experimental orchard in 1949, bentonite sulphur dust alone was compared with bentonite sulphur dust containing 30 per cent hydrated lime, and with bentonite sulphur dust containing approximately 0.15 per cent dicyclohexylamine dinitro-o-cyclohexylphenate in every application through the post-bloom period. A severe infestation of red mites occurred in each case, with little or no difference apparent as a result of the different mixtures.

A mixture of bentonite sulphur containing 0.1 per cent parathion seemed promising, but the work was of a preliminary nature, and no conclusions can be drawn at present. Also because of its poisonous nature, parathion should not be used except with strict precautions.

* Now known as Karathane.

OYSTER-SHELL SCALE. F. H. Lathrop. Two applications of DDT (5% dust or three pounds 50% wettable powder in 100 gallons of water) again gave excellent control of oyster-shell scale on apple trees, when applied just as the scales were hatching. Apparently DDT is solving the problem of oyster-shell scale control in Maine orchards. In some orchards, however, it has been noticed that many scales have survived under loose bark on the tree trunks. It may become necessary to give special attention to the treatment of the trunks and large branches of old trees where there is much loose bark.

PLUM CURCULIO. F. H. Lathrop. The application of sulphur-lead arsenate (85-15) dust in the petal fall and the first cover, reduced plum curculio injury about 80 per cent. The addition of 5 per cent DDT to the sulphur-lead arsenate dust did not materially reduce the curculio injury.

APPLE FRUIT FLY. F. H. Lathrop. The emergence of the flies in

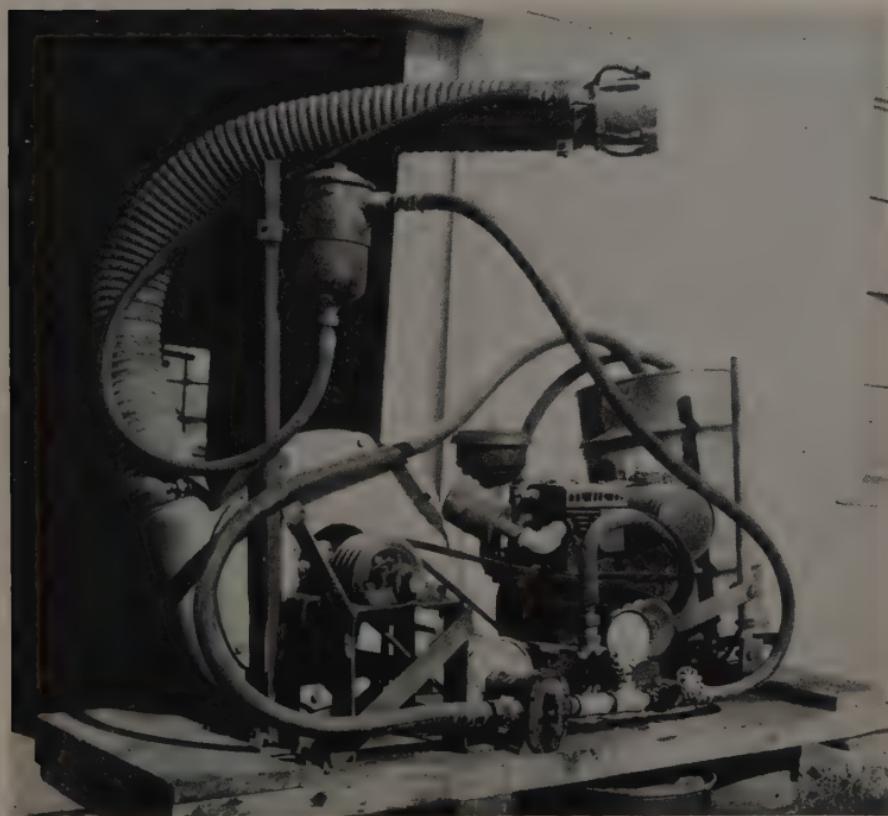


FIGURE 1. Experimental Spray Machine Used to Apply Mist Concentrates of the Various New Organic Pesticides.

1949 was almost exactly on the normal schedule the past 15 years. The information on fly emergence is sent out by county agents to guide growers in the proper timing of spray and dust applications.

Four applications of sulphur-lead arsenate (85-15) dust applied for fruit fly control in a severely infested orchard, reduced infestation of the fruit about 50 per cent. The addition of either 30 per cent of hydrated lime or 0.15 per cent of dicyclohexylamine dinitro-o-cyclohexylphenate to the sulphur-lead arsenate dust mixture, had little or no effect upon fruit fly control.

CONCENTRATED MIST SPRAYER FOR APPLES. M. T. Hilborn, F. H. Lathrop. In 1949 an experimental sprayer for applying concentrated pesticides in an air blast was designed and built at Highmoor Farm. Preliminary observations indicate that this method is well adapted to applying most spray materials to apple fruit and foliage. The data on the effectiveness of the spray materials for the control of diseases and insects on apples are incomplete, but this phase of the work will be rapidly expanded.

CONTROLLED ATMOSPHERE STORAGE OF MAINE APPLES. F. P. Eggert. Considerable difficulty has been encountered in making the first room gastight by the methods used. Since construction had not been satisfactorily completed, it was not possible to conduct storage experiments of this type during the 1949-50 season. A second storage room has now been gas-proofed, using heavier weight aluminum. All joints were lapped at least two inches, sealed with caulking compound, and nailed every two inches to insure a well-sealed joint. This room is satisfactorily gas tight and will be ready for experimental work in the fall of 1950.

FROZEN CONCENTRATED APPLE JUICE. M. E. Highlands, J. S. Getchell. Initial results indicate that a blend of 20 per cent green McIntosh and 80 per cent ripe McIntosh apples gave the best flavored frozen concentrate product. Cortlands gave only a fair quality product. Samples of juice treated with clarifying agents, such as pectinol, produced a product pleasing to the eye, but lacking in body and flavor. Analyses on samples prepared this year are being carried out. Plans for expanded work for the coming year include the preparation of additional materials as well as storage tests.

IMPROVEMENT OF PRE-PROCESSING AND FREEZING METHODS FOR MCINTOSH APPLES. M. E. Highlands, J. S. Getchell. Analyses of samples prepared the preceding year have been completed. Most significant is the calcium uptake in the pre-treat of apple slices prior to freezing, ranging from 0.00930 per cent for samples treated with 0.1 per cent calcium chloride to 0.00365 per cent for samples treated with 0.025

per cent calcium chloride. Samples containing the highest calcium content showed greatest firmness on defrosting. Samples treated with 0.05 per cent sodium bisulphite to prevent darkening were superior to those treated with ascorbic acid. Samples frozen with sucrose syrup were superior in texture, flavor and appearance to those frozen without any additional sweetening. Firmness tests based on pressure data showed no significant differences between the various levels of added calcium.

MEASURING BRUISES ON McINTOSH APPLES DURING EACH PHASE OF THE MARKETING PROCESS. H. C. Woodward. The study which began three years ago was continued during the 1949-50 marketing season giving emphasis to the bruising occurring to McIntosh apples during picking, transporting, and the grading of the apples. The amount of bruising occurring during the picking operation was closely associated with the kind of labor used and the care exercised in picking the fruit. A large variation in the number and size of bruises was found on apples in different orchards and also in the same orchard from one year to the next.

Additional information on the amount of bruising occurring in transporting apples by growers and shippers again showed considerable variation. Some comparisons were made on the amount of bruising occurring in grading apples by hand and by machine graders. The amounts were approximately the same by the two methods but apples graded by machines had more stem punctures than those graded by hand.

A summary of the data obtained in previous years was published in December, 1949 as Station Bulletin 478, "Quality of Maine McIntosh Apples from Orchards to Consumers."

QUALITY OF APPLES IN RETAIL STORES IN PORTLAND, MAINE.* H. C. Woodward, C. H. Merchant. Twenty-five retail grocery stores in Portland cooperated in this project during January, February, and March, 1950. A large variation was noted in the amount of bruises on the apples displayed at retail stores. Some lots of apples had relatively few bruises while other lots had many badly bruised apples. Also the information is being carefully studied to ascertain the apparent competitive effects of the retail prices of the other fruits on apple prices.

CONSUMER ACCEPTANCE OF COMMERCIALY GRADED AND BRUISE FREE McINTOSH APPLES. C. H. Merchant, H. C. Woodward. In the fall of 1949, a study was undertaken to measure consumers acceptance of bruised McIntosh fruit in two super markets in Portland, Maine. Two

* Cooperative Northeast regional apple marketing study including cooperation of Northeast Agr. Exp. Stations, Bur. Agr. Econ., and Prod. and Mkt. Admin., U. S. Dept. Agr.

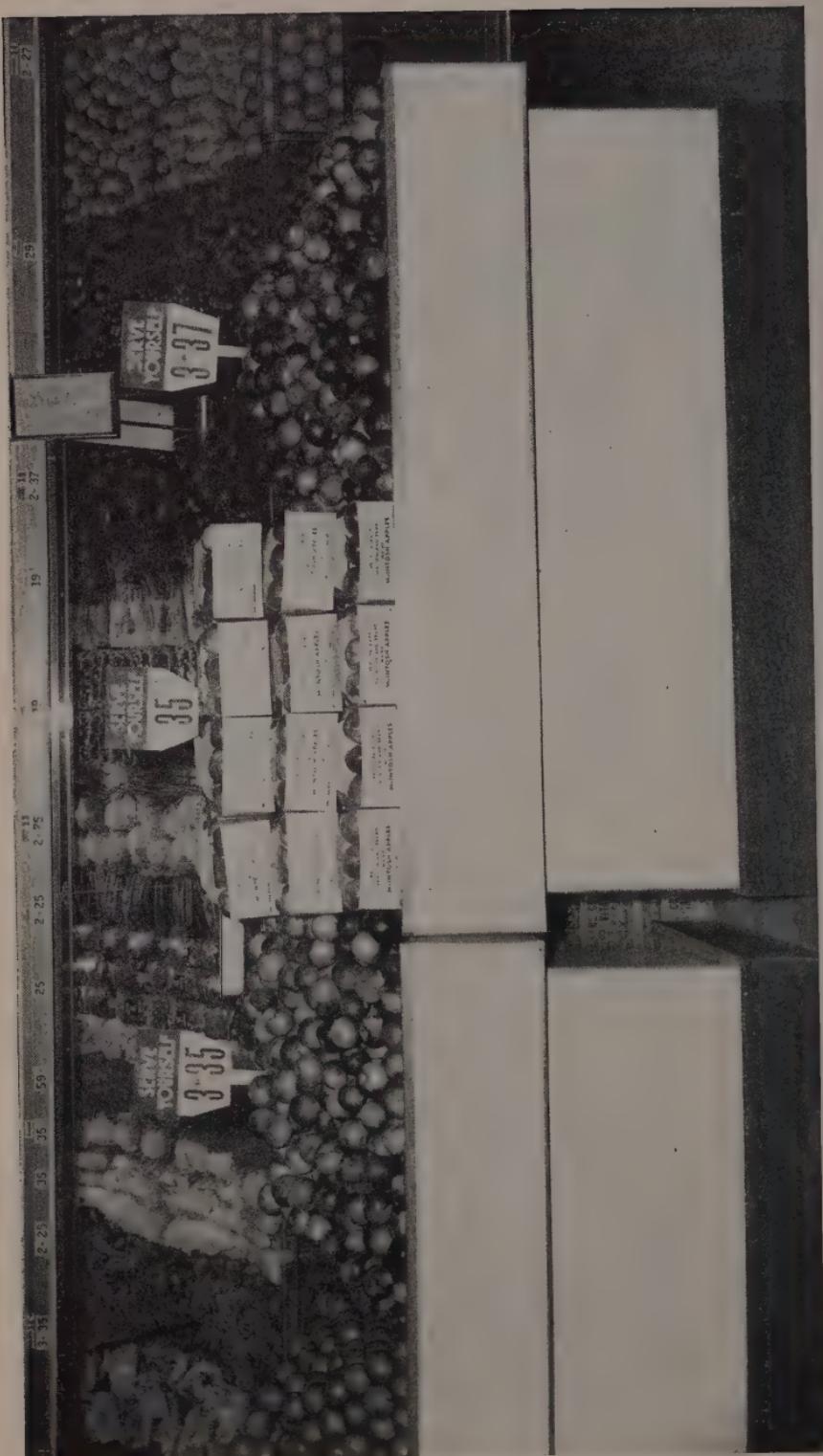


FIGURE 2. Retail Store Display of McIntosh Apples.

The lot on the right was handled the usual way while the lot on the left consisted only of "bruise free" apples. Consumers showed a preference for "bruise free" apples but were unwilling to pay much of a premium over commercially handled fruit.

bulk lots of apples were displayed on the same table in order that consumers could make a quick comparison of the quality. One lot consisted of commercially graded McIntosh apples. The other lot was a "bruise free" display of apples which were as nearly identical as possible to the first lot, except that all bruised apples were removed from the commercial grade.

During the first three weeks of the study, "bruise free" apples were priced two to four cents higher than the commercially graded apples for 4½ pounds. For the last two weeks of the study, the two lots of apples were priced the same. The information shows that consumers had some preference for "bruise free" fruit but were unwilling to pay much of a premium for it.

While the contrast in the number and sizes of bruises on the apples in the two displays was noticeable to most consumers the commercial packed apples contained less bruises than was observed in many other retail stores. It may be reasonable to expect that if the commercial packed fruit had been more severely bruised, consumers would have indicated a much stronger preference for the "bruise free" apples and possibly would have been willing to pay a higher premium for the "bruise free" fruit.

BEANS

BREEDING BEANS RESISTANT TO HALO BLIGHT. R. M. Bailey, Donald Folsom. The dry weather in the summer of 1949 prevented the production of an epidemic of halo blight in the breeding plots of snap, shell and field beans. The work of developing resistant varieties will be continued in 1950.

FIELD BEAN TRIALS. R. M. Bailey. In a yield trial of 14 bean selections of yellow type and two strains of State of Maine Yellow Eye, several of the selections yielded as well as the standard strains and matured several days earlier. These are thought to possess somewhat greater resistance to anthracnose. Tests of baking quality have not been made as yet. A selected bush strain has been named Highmoor Yellow Eye and seed is available through commercial channels. This strain is of excellent baking quality, has yielded as well as the commonly used semi-runner Old Fashioned Yellow Eye and matures a few days earlier.

CHEMICAL WEED CONTROL IN SNAP BEANS. M. F. Trevett, Robert Littlefield. A selective dinitro material applied as a pre-emergence treatment at the rate of one gallon of the 13 per cent concentrate per acre had no harmful effect on either plant stand, yield, or quality of Pencil

Pod wax beans. Similar results were obtained in 1948 with the variety Tendergreen. On the basis of two years' data, safe control of susceptible weeds in snap beans appears possible with selective dinitro herbicides.

BLUEBERRIES

A much more effective blueberry research program has been developed as a result of the blueberry tax, enacted in 1945 by the Maine Legislature. From this industry tax of about 5½ cents per bushel, a total of \$18,463.62 was used during the year 1949-50 for research purposes, including the operation of Blueberry Hill Farm at Jonesboro. The blueberry tax funds were supplemented by about \$12,700.00 from Federal and other State research funds, which provided for the blueberry work summarized in this section.

BLUEBERRY DISEASES. M. T. Hilborn, Marilyn Noyes. Twig blight continues to be an important problem in some blueberry fields, particularly those in the coastal area. Preliminary observations indicate that exposure of the plants to wind blown salt spray may be a factor in the twig blight complex. This phase of the problem will be studied under controlled conditions in the greenhouse. An increase has been noted in the occurrence of the red-leaf disease (*Exobasidium* sp.). Leaf rust and powdery mildew continue to be important.

It has been found that several new organic fungicides may safely be applied to blueberry plants. Experiments are under way using Bioquin I, Dithane, Parzate, Phygon, and Zerlate in an attempt to determine if these diseases can be economically controlled by an organic fungicide. Experimental plots have been established with interested growers where 20-20-60 and Fermate dusts are being compared as to relative disease control and effect on yield.

FERTILIZING LOW-BUSH BLUEBERRIES. M. F. Trevett. The results of three years' fertilizer experiments show that if blueberries are fertilized the spring of the first crop year the chances are 22 to 1 that first crop yields will be reduced slightly, but the chances are 48 to 1 that second crop yields will be larger than from unfertilized fields. In every case thus far the second crop on fertilized areas has been about double that of the unfertilized, with yields ranging from 60 to 80 per cent as large as first crop yields. The chances are 8 to 1 that the total yield from the first and second crops combined will be larger on fertilized fields.

Complete fertilizers have not been consistently better than nitrogen alone.

Optimum amounts of nitrogen to apply, depending upon plant



FIGURE 3. The New Liqui Duster as Modified for Use in Blueberry Fields.

The fish-tail fan, at right, has been extended and turned so that the dust cloud gives adequate coverage of low bush blueberry plants. Small quantities of water are sprayed into the dust which can be applied to the plants as a mist when the leaves are dry. Such equipment may be used throughout the day, wind permitting, rather than only in the morning and evening when there is dew on the plants.

vigor and weed population, apparently range from 10 to 40 pounds per acre.

CHEMICAL WEED CONTROL IN LOW-BUSH BLUEBERRIES. M. F. Trevett, A. E. Prince. Ammonium sulfamate, at a concentration of one pound of the salt to one gallon of water, did not give complete control of Red Maples. However, 40 per cent of the Red Maples treated in 1948 did not resprout in 1949. Thus, over a period of 2 to 3 years, eradication should be possible. Apparently a weed control program in blue-

berry fields should be planned for a 3 to 5 year period, since even the more susceptible weeds may not completely succumb to one herbicidal treatment.

Although numerous trials have been made with many different chemical herbicides, a material has not yet been found that is both effective as a weed killer and harmless to blueberry plants. Consequently the herbicides must be sprayed carefully on the weeds without seriously wetting the blueberry plants. Compounds of 2,4-D are thus far the least harmful to blueberry plants and are effective in controlling alders, birch, sweet fern, and several types of willows.

INCREASING PLANT STAND IN BLUEBERRY FIELDS. F. P. Eggert, F. W. Peikert. Work has been started to determine a practical means of establishing a stand of plants on a prospective blueberry field. On one plot, rhizomes were spread on the surface of the soil and disked under. On a second plot, the rhizomes were cut into approximately six-inch lengths, spread on the surface of the soil and disked under. One half of each of these plots was compacted by using a meadow roller. Another plot was established by transplanting blueberry sods cut out by the golf-hole cutter.

The effects on stand brought about by disking to level the soil is under observation in another series of plots. One half of the soil of each of these plots has also been compacted as a means of conserving moisture and to ensure better soil contact with the rhizomes.

PRUNING EXPERIMENTS ON THE LOW-BUSH BLUEBERRY. F. P. Eggert, F. W. Peikert, I. C. Mason. Five treatments have recently been made to determine a better method of pruning than conventional burning. The treatments consist of burning by flame thrower, mowing, mowing plus a herbicidal oil, herbicidal oil alone, and mowing with a rotobeater. It is too soon for any major differences to have yet become apparent.

IRRIGATION OF BLUEBERRIES. R. A. Struchtemeyer, M. F. Trevett, H. J. Murphy. During the summer of 1949, the applications of supplementary water to blueberries did not give significant results since apparently enough natural rainfall was available for plant growth. Yields were high, being 50 bushels per acre for the non-irrigated plots, and 52 bushels for the irrigated plots. This indicates that good yields can be obtained without irrigation if an adequate supply of water is available to the plants.

BLUEBERRY FRUIT FLY. F. H. Lathrop. The flies emerged from the soil about 2 weeks earlier in 1949 than in 1948. In 1949 flies began to emerge on June 20, 50 per cent had emerged by July 1 and 95 per cent had emerged by July 13.

In tests of 6 different dust mixtures for fruit fly control, the recommended 50-10-40 (calcium arsenate-monohydrated copper sulphate-hydrated lime) mixture caused considerably less injury to the blueberry plants than did straight, undiluted calcium arsenate. The 50-10-40 mixture gave satisfactory control of fruit fly, and remains the most practical and economical material so far tested. Dust in which an insoluble copper compound was substituted in place of the monohydrated copper sulphate, caused slightly more injury to the blueberry plants than did the 50-10-40 dust. Further tests of Rotenone-Pyrenone dust mixtures, showed them to cause no perceptible injury to the blueberry plants, but they were inadequate for fly control when applied twice at the rate of 6 pounds per acre at each application.

BLUEBERRY THIRIPS. F. H. Lathrop. DDT applied as 5 per cent dust in the early spring, just as the blueberry blossom buds were separating in the clusters, appeared to reduce the thrips injury on previously heavily infested blueberry land. DDT applied as a concentrate mist spray, 1 pound of 50 per cent wettable powder per gallon of water, was distinctly more effective than the 5 per cent DDT dust. Parathion was no more effective than DDT for thrips control, and because of the extremely poisonous nature of parathion, it is not recommended for use on blueberries at present. Chlordane did not appear to be quite as effective as DDT for thrips control.

COSTS OF BURNING OVER BLUEBERRY LAND. G. F. Dow, R. H. Groder, Irvin Mason. Of 170 blueberry growers interviewed during the winter of 1949-50, one-third burned over their blueberry land every three years, and two-thirds used a two-year burn. The proportion following a three-year burning cycle varied from 7 per cent in Knox-Lincoln counties to 69 per cent in Washington county.

The average yield per acre during 1949 was 750 pounds for the first crop in a two-year burning cycle, in comparison with yields from a three-year cycle of 994 pounds for the first crop and 414 pounds for the second crop. On the basis of 1949 yields, the total production over a six-year period would be 2250 pounds of berries for those using a two-year cycle, as compared with 2808 pounds for those with a three-year cycle. The former group during the six-year period would have the expense of burning their fields three times in contrast to only two times for the latter group.

The average cost of burning was \$16.20 per acre. This cost varied from an average of \$16.61 for those using hay, to \$10.90 for those using a commercial oil burner. A few growers, who had considerable grass and weeds among their blueberries, and did not add any hay or oil, had a cost of only \$1.31 per acre for burning. The cost per acre for burning

with hay included \$10.78 for the hay delivered at the field, \$4.69 for spreading the hay, and \$1.14 for labor in burning. An average of 1124 pounds of hay was used per acre.

Burning costs per acre varied considerably due to a number of factors. Important factors with the oil burner included the size of the field, the condition of the field as to smoothness, moisture conditions, and the skill of the operator. Growers estimated that the oil burner could not be used for burning over any appreciable amount of the land on about one-fourth of the fields, due to roughness, rocks, or other factors. On slightly over one-third of the fields, all of the land was adapted to the commercial oil burner. On the remaining fields, the burner could be used for part of the land.

The average cost of cutting weeds and bushes was \$5.86 per acre of land burned over.

ELECTRIC FENCE TO CONTROL DEER.* Irvin Mason. An electric fence around the experimental plots at Blueberry Hill Farm has been used since 1948 with variable success. At first, one fine strand of electrically charged wire was fairly effective when placed 18 inches above the ground, with a second heavy strand of uncharged wire placed on 4 foot posts 3 feet inside of the charged wire. Some deer, however, apparently learned the secret of stepping over the lower wire and under the higher wire. The next step was to string another strand of electrically charged wire midway between the other two strands. This also has not been completely successful, with considerable evidence of deer crawling under the lower strand where hollows exist, or jumping between the strands where they are wide apart. Two additional strands of electrically charged wire are now being tried which narrows the spaces between strands through which deer may enter the blueberry field.

BLUEBERRY STEMMING DEVICES. M. E. Highlands. A machine widely used in the west for stemming grapes, gooseberries and currants was tried on Maine blueberries containing a large percentage of stems and clusters, but the results were poor. The Atlas Pacific Machinery Company, producer of this equipment, indicated that the machine is not adapted for use with blueberries.

Another machine, developed by the Tennessee Agricultural Experiment Station, successfully stems and caps strawberries but did not do a satisfactory job on stemming Maine blueberries. However, Dr. A. H. Morgan of the Tennessee Station believes that the equipment might be modified to handle blueberries successfully.

* Cooperative project with Maine Dept. Inland Fisheries and Game.

CANNED BLUEBERRY PIE MIX. M. E. Highlands, J. S. Getchell.* A formula suggested by the National Starch Products Company has been modified and developed to give an excellent canned blueberry pie mix. This is a complete pie mix which the housewife or baker has only to add to the prepared pie shell, cover, and put in the oven. There is no separating of berries from the juice, and the usual discarding of some of the juice. The entire contents of the can can be used successfully.

The formula and directions for producing this mix may be obtained from the Experiment Station.

BROCCOLI

EXPERIMENTS WITH BROCCOLI FOR FREEZING. G. L. Terman, C. E. Cunningham. Favorable moisture conditions resulted in high yields of cut broccoli in 1949. Average yields for various fertilizer treatments on a green sprouting variety were 6920 pounds per acre at Orono and 7850 pounds at Presque Isle. An early selection yielded 7880 pounds at Presque Isle from the use of a starter solution and side dressing with 30 and 60 pounds of nitrogen as compared with 1500 pounds of a 6-9-9 fertilizer applied in row side bands with a potato planter. At Orono similar treatments did not increase yields. Applying ground limestone in the row was not beneficial in these tests.

Seed planted in the field at Orono on May 24, resulted in an average yield of 4430 pounds which was 2490 pounds less than the yield obtained from plants started in the greenhouse and transplanted on May 24. The first cutting was 2 weeks later for the field-planted seed.

The production of high quality broccoli for freezing requires harvesting at three-day to weekly intervals, depending on the weather. With plants set June 1-2 at Presque Isle, cuttings were made from July 16 to September 16.

CHERRIES

ESTABLISHMENT OF EXPERIMENTAL SOUR CHERRY ORCHARD. F. P. Eggert, M. T. Hilborn, F. H. Lathrop. A total of 500 Mazzard cherry seedlings and 500 Mahaleb cherry seedlings have been purchased for use as rootstocks. These will be used to develop trees of the Montmorency variety to start an orchard for experimental purposes.

* Heat penetration tests were made by Mr. Buell Blair of American Can Company.



FIGURE 4. Effect of Soil pH on Broccoli and Cauliflower.

Above—Healthy broccoli plants which produced nearly 3.5 tons of cut broccoli per acre on soil testing pH 5.6.

Below—Broccoli and cauliflower plants grown on a soil testing pH 4.6 and affected by a nutritional disease commonly known as whiptail. Cauliflower plants at left were severely affected and produced no yield. Broccoli plants at right were less severely diseased. Best growth of both crops is usually obtained on soils testing pH 5.5 to 6.5.

CORN

SWEET CORN BREEDING.* R. M. Bailey, B. E. Plummer, Jr., J. M. Banton. A project to develop better sweet corn hybrids for canning is in progress in cooperation with the Maine Canners Association. More than 1000 sweet corn breeding plots were grown at Highmoor Farm in evaluating breeding stocks and hybrids. As a result of the severe drought, the comparative yield trials were considered to be of little significance. A list of suggested sweet corn hybrids for canning, home garden and market was given in last year's report. Golden Jewel is a new market type hybrid that appears worthy of trial. It matures slightly later than Early Golden 1.13. Preliminary studies have indicated that Mass. 32 sweet corn inbred may be advantageously substituted for Purdue 1339 in the production of canning type hybrids. Hybrids of Mass. 32 were compared to those of Purdue 1339 in 18 comparisons. The hybrids of Mass. 32 were found to average about a day earlier in maturity, equal in vegetative vigor, to produce slightly longer and larger ears with slightly narrower kernel. Quality comparisons based on taste and tenderness of the raw product, however, indicated that the Purdue 1339 hybrids were slightly superior. Quality comparisons after processing are expected to be made this year.

SWEET CORN VARIETY TRIALS. E. F. Murphy. Of six varieties of sweet corn on trial in Presque Isle, Early Golden 1.13, Sugar and Gold, and Northland yielded significantly more (24 to 31 lbs. per 75 feet) than Dorinny, Smith's Golden Bantam, and Mason's Golden Midget (15 to 18 lbs.). All the varieties matured before September 10. Sugar and Gold was the earliest maturing (August 14), being 2 weeks earlier than Smith's Golden Bantam and Dorinny. Unfavorable conditions reduced the yields of similar corn varieties, in Orono, with no significant differences in yield between varieties.

Of 6 sweet corn varieties frozen on the cob according to methods recommended for home processing, Mason's Golden Midget rated first in palatability after 4 and 6 months' storage. Dorinny rated second and, after 6 months' storage, was significantly more palatable than Sugar and Gold, Northland, and Golden Bantam, which did not differ from each other nor from Early Golden 1.13.

The B-carotene content of Mason's Golden Midget was highest (1.81 gamma/gram) of the 6 varieties tested, and Early Golden 1.13 was lowest (.58 gamma). The kryptoxanthol (vitamin A) content was highest for Northland at 1.87 gamma and was lowest for Dorinny at

* Financial assistance was given this work by the Maine Canners' Assn.

0.61 gamma. Blanched, frozen corn on the cob was not significantly different from fresh corn in carotene value after 3 months' storage.

CHEMICAL WEED CONTROL IN SWEET CORN. M. F. Trevett, Robert Littlefield. The higher rates of application of 2,4-D triethanolamine salt to Hybrid C sweet corn gave excellent control of broad-leaved weeds for a period of five to six weeks. The average percentage reduction in broad-leaved weeds on August 22, with cultivation of both the treated and untreated plots, was 89 per cent with 2.0 pounds of 2,4-D acid applied per acre, 85 per cent with 1.5 pounds, 65 per cent with 1.0 pound, and 49 per cent with 0.5 pound. Control of barnyard grass was poor, even with the higher applications.

There was no appreciable difference in the effectiveness of weed control as measured on August 22 for 2,4-D applied before the corn emerged, when the corn was 0.5 to 1.0 inch tall, or when the corn was 4 to 6 inches tall. Information on the August 25 height of the corn plants and the yield of corn indicated that the effect of the 2,4-D applications was limited entirely to the suppression of weed growth. Corn varieties differ, however, in their tolerance to 2,4-D. Indications are that Early Top Cross and Dirigo are quite sensitive to 2,4-D; Golden Cross Bantam, Pilgrim, Hybrid C, Early Golden 1.13, Carmelcross and Top Cross Maine Bantam apparently are intermediate in tolerance; with Marcross being quite tolerant.

A pre-emergence application of a 13 per cent dinitro selective weed killer gave as good control of broad-leaved weeds as the higher rates of 2,4-D. In all these tests, the longer the pre-emergence treatment can be deferred, the more effective is the treatment.

FIELD CORN TRIALS. R. M. Bailey, B. E. Plummer, Jr. Trials of flint, flint-dent and dent field corn hybrids were conducted at Highmoor Farm last season. Several new experimental all flint combinations appeared promising for short season locations. One new flint-dent double cross was superior to Maine B in earliness, yield and vegetative vigor. It will be studied more intensively this year. One new three-way cross, W85 x W15 x SD105, was outstanding and a trial seed plot is planned for this season. The performance of nine early dent inbreds was tested in 36 single crosses in cooperation with the Massachusetts Agricultural Experiment Station and the Northeastern Corn Conference. Quantitative analyses of protein and fat were determined on 5 dent, 25 flint-dent and 13 flint grain corn hybrids. Average protein values were 12.48, 13.09, and 15.37 per cent, respectively. Fat values were 4.63, 4.96, and 5.79 per cent. Average dry matter percentage of the ears at harvest was 57.2, 59.6, and 64.6.

EUROPEAN CORN BORER.* J. H. Hawkins, A. S. Getchell, B. E. Plummer, Jr., J. M. Banton. The European corn borer is most likely to survive when the eggs are laid on corn in the mid-green tassel stage when the pollen is about to fall from the tassels. There appears to be little need for insecticidal treatment of any corn before the early whorl stage is reached, and for factory corn the treatment may be delayed until the late whorl stage.

Two applications of Ryania, made on July 22 and July 27, gave almost as effective control as did 3 applications beginning on July 17.

Ryania is a safe insecticide for use in European corn borer control, but a little less effective than DDT. DDT sprays were very effective, but DDT is not safe to use when any part of the corn other than the grain is to be fed to livestock. Parathion is effective in borer control, but is so dangerous to those applying or handling it that it is not recommended for general use.

A low-pressure sprayer costing about \$175.00 was used effectively in the European corn borer control during 1949.

A survey was started last year and is being continued to determine centers of infestation, time when the borers are hatching, and the numbers being hatched.† These facts assist growers in determining what corn fields should be treated with insecticides, and in timing the applications. The spring survey also showed that heavy infestations this year were confined mostly to a few relatively small fields, which should have been cleaned up after the land had been fitted for planting.

Two species of European corn borer parasites were liberated in Maine in 1949.† Neither species has been recovered to date, although borers have been found to be parasitized by a native insect parasite.

Light traps provided data on the time when the European corn borer moths were flying. Although the practical value of light traps for controlling moths is still open to question, methods of making light traps more effective are being studied.

In 1950, eggs of the first generation borer were laid as early as June 14. There appears to be danger from infestation in central Maine by two generations instead of only the one generation prevalent during the past few years.

Experimental work on the European corn borer has been summarized in Maine Extension Bulletin 401 "European Corn Borer Control" by J. H. Hawkins and J. C. Hickey.

* Financial assistance was given this project through the Maine Dept. Agr. from income received from the corn tax.

† Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

DAIRY

POSSIBLE MINERAL IMBALANCE IN DAIRY CATTLE. H. C. Dickey.

Symptoms of cobalt deficiency were exhibited by young dairy heifers being fed a mixed hay and grain ration of yellow hominy, oats, wheat bran, corn distillers grains, soybean oilmeal, and steamed bone meal. These symptoms were a lack of appetite, emaciation, long, rough hair coat, wood chewing, scaliness of the skin, and greatly retarded growth. This condition has been corrected by dissolving one ounce of cobalt sulphate in one gallon of water and placing one teaspoonful of this solution on the grain fed once each day. After three days of cobalt feeding, the appetites greatly increased, and at the end of three weeks' time gains up to forty pounds per head had been made. This rapid recovery is characteristic following the use of cobalt.

VALUE OF DEHYDRATED POTATOES AS A CONCENTRATE FEED FOR DAIRY CATTLE. H. C. Dickey.

Feeding trials during each of the past two years show that 360 pounds of dehydrated potatoes will replace an equal amount of corn or hominy feed per ton of grain mix when fed to dairy cows. However, the dehydrated potatoes are unpalatable and the cows have to gradually develop a liking for them, or else molasses or some other palatable feed should be added to the grain mix. Also the carotene or vitamin A, which is fairly high in corn or yellow hominy, is lacking in potatoes. However, corn silage, grass silage, and good quality hay can supply sufficient amounts of carotene.

The results this year were obtained from feeding two lots each of 5 Holstein cows for a 42-day period; and then reversing the rations for another 35 days, following a 7-day transition period. The dehydrated potatoes replaced 200 pounds of yellow hominy feed, in a regular ration of 500 pounds of yellow hominy feed, 400 pounds of ground oats, 100 pounds of corn distillers grains, 100 pounds of soybean oilmeal, 10 pounds of steamed bonemeal, and 10 pounds of salt. Both groups were fed hay and grass silage.

PREDICTING THE TRANSMITTING ABILITY OF HERD Sires. H. C. Dickey, R. F. Evans, H. W. Hall.

An additional refinement of one of the methods of predicting inheritance as outlined in Station Bulletin 473, June 1949, has been injected into this study of Holstein sires. The procedure followed was that of regressing the "regular pedigree" predicted values half way toward the breed average. The new "regressed pedigree" value overestimates the production of the sons' daughters an average of only 417 pounds of milk, whereas the regular pedigree value overestimated production by 836 pounds. However, the reliability of the regressed pedigree method of prediction was not appreciably better than

the former method, except for production above 10,000 pounds of four per cent milk. More study is needed for predicting sons' daughters above the breed average. The additional results of this study are being published in the *Journal of Dairy Science*.

The study of cow families in the Guernsey breed as a basis for the selection of dairy sires was continued using three generations of cows in a direct line of descent on the maternal side of the pedigree, together with all daughters of these three cows. The results show that the actual milk production record of the cow family gives a slightly better indication of an offspring's transmitting ability than does the dam's record alone. The most reliable predictions of an offspring's transmitting ability of milk production were obtained when the cow family included three to six cows. The predictability of an offspring's transmitting ability for cow families containing from seven to fourteen cows was practically zero. These results indicate that when the production records of too many collateral ancestors in a cow family are considered, erroneous conclusions are often reached in selecting a dairy sire.

FACTORS WHICH MAY INFLUENCE THE SECRETION OF MILK AND FAT CONTENT. R. F. Evans, H. C. Dickey. Tests are being made with three groups of Jersey cows for a period of 60 days. Tocopherols (vitamin E) are being fed one group, and cod-liver oil to another group, for comparison with a third group fed the regular ration. No data are yet available for publication.

MAINTAINING BUTTERFAT TEST OF MILK SAMPLES. L. M. Dorsey. Milk samples of the University of Maine herd of 60 cows composited for 15 day periods using mercuric chloride (standard preservative) or sodium fluoride have suffered an average fat loss of 0.123 per cent. Samples preserved with acetophenone alone, or in combination with the above preservatives, did not suffer any loss in test. Chloropicrin is another lipase enzyme inhibitor which prevented loss in butterfat test.

Lipase enzyme activity in milk samples held overnight also caused a decrease of about 0.05 per cent in the test of individual cows affected by spontaneous rancidity. This decrease represented a loss of 0.025 per cent in the DHIA daily composite milk sample, which also included mornings' milk. About 30 per cent of the milking cows in the University herd had spontaneous rancidity. One half of these cows under DHIA testing procedure would have been credited with one-tenth per cent less test than the actual butterfat content of the milk as secreted.

The results reported above were obtained during the stabling period while cows were barn fed. Within 18 hours after cows were turned onto pasture, the loss in fat test was completely eliminated for milk samples held overnight or for 15 day composite samples. This indicates that

pasture grass contains a lipase inhibiting factor that protects milk fat against hydrolysis.

REGIONAL STUDY ON SEASONAL MILK PRODUCTION.* W. E. Pullen. A cooperative regional study was undertaken during the summer of 1948 dealing with the seasonality of milk production adjustments and opportunities available for different producers. A preliminary mimeographed report entitled, "Factors Influencing the Seasonal Adjustments of Milk Production on Farms in the Boston Milkshed," was prepared by H. A. Luke and W. E. Pullen of the Maine Station and was published in October 1949 by the Bureau of Agricultural Economics. This study shows ways individual farmers can adjust their milk production to meet market demands and also points out the difficulties involved on many farms in making these necessary adjustments.

SEASONAL PRODUCTION DATA FROM DAIRY FARM MANAGEMENT STUDIES, 1928-43. G. F. Dow. Additional analysis has been made for the nearly 1000 dairy farm records obtained in previous years. When cows were on pasture from mid-May to mid-October, there was a reduction of 46 per cent in grain fed, 86 per cent in roughage other than pasture, and 31 per cent in labor used daily in caring for the cows. The average reduction in feed and labor costs per cow per day, after charging the cost for pasture, was 48 per cent below that for the winter stabling period.

Although milk can be produced much cheaper on pasture than during the winter season, the herds with a relatively large number of fall freshening cows did not have any appreciable increase in the annual cost of milk production per cow. Obviously, both spring and fall freshening cows benefit from lower feed and labor costs while on pasture. The fall freshening cows also tend to produce more milk per cow annually than do those that freshen in the spring.

The effect of hot weather, pasture condition, and hay quality on milk production also are being analyzed. Preliminary data indicate that the effect of amount and quality of feed on seasonal milk production is more important than was formerly recognized.

RELATIONSHIP OF MARKET SUPPLY AREAS AND MILK PRICES.† H. B. Metzger. The part of the Maine Station in this regional study is to outline the milksheds in Maine and to analyze the price relationships which have existed among the milksheds of local markets and Boston.

* Cooperative regional study including the Bur. of Agr. Econ., U. S. Dept. Agr., the Maine, New Hampshire, and Vermont Agr. Exp. Stations, and the Boston Milk Administrator's Office. The study was under the leadership of M. S. Parsons of the Bur. of Agr. Econ. and was financed to a large extent by Research and Marketing Act funds allocated through the Bur. of Agr. Econ.

† Cooperative Northeast regional dairy marketing study.

This study should help to reveal uneconomic situations with respect to milk supply procurement and indicate any existing price differentials contributory to unequal volumes of surplus milk among markets. The assembling of the data for this study will be completed by October 1950 and the material will be summarized during the year ending June 30, 1951.

CONSUMPTION OF DAIRY PRODUCTS.* H. A. Luke. The results of this study have been published as Station Bulletin 477, "Consumer Use of Dairy Products in Portland, Maine," November 1949. The report includes the amount of dairy products consumed, their use or purpose for which purchased, factors influencing consumption, and consumer acceptance of certain milk distribution practices.

MILK DISTRIBUTION COST. G. F. Dow. The cost of milk distribution has been brought up to date at the request of the Maine Milk Dealers Association. Data obtained from ten of the larger distributors showed that labor cost had advanced 27 per cent since February 1946, representing an increase in cost of nearly one cent per quart of milk. Cost for other items was equivalent to an additional cost of 0.63 cents per quart of milk distributed. The increase in cost of milk distribution was approximately equal to the increase in spread allowed milk distributors under minimum prices established in most markets in Maine. Results of this study were presented in mimeograph form at a public hearing of the Maine Milk Commission on March 15, 1950.

FORAGE CROPS

FEEDING VALUE OF BARN-DRIED VERSUS FIELD-CURED HAY. H. C. Dickey, B. E. Plummer, Jr., Judith Banton. Four young dairy heifers fed hay dried in a Martin haymaker gained 220 pounds per head in 175 days as compared with 195 pounds for four other heifers fed field-cured hay. These heifers weighed about 265 pounds per head at the start of the winter feeding period. They were fed an average of 6.7 pounds of hay and 3.0 pounds of grain per head daily. Each lot of hay was obtained from adjacent areas within the same field. The chemical analyses showed that field-cured hay contained an average of 8.10 per cent moisture, 9.98 per cent protein, 2.55 per cent fat, 30.83 per cent fiber, 4.19 per cent minerals and 44.35 per cent N.F.E. The hay dried in a Martin haymaker contained an average of 11.30 per cent moisture, 7.57 per cent protein, 2.22 per cent fat, 32.17 per cent fiber, 5.08 per cent minerals and 41.66 per cent N.F.E.

These results differ from those obtained the previous year in which Hereford steers receiving mow-dried hay gained 168 pounds per head as compared with 188 pounds for those fed field-cured hay.

* Cooperative Northeast regional dairy marketing study.



FIGURE 5. These Four Dairy Heifers Fed Hay Cured in a Martin Haymaker Gained More Weight Than Four Others Fed Field Cured Hay.

MANAGEMENT OF LADINO-GRASS PASTURES. C. H. Moran, H. C. Dickey, H. J. Murphy. Twelve pasture plots of ladino clover grass combinations located on the Rogers Farm, Stillwater, Maine, were rotationally grazed by heifers during the summer of 1949. Six of these were grazed continuously throughout the summer. The other six plots were first harvested for silage when the grass was in the early head stage, and allowed to recover to a height of 8 inches before grazing. The results, which were measured by gain in animal weight, amount of dry matter produced, and botanical composition of the herbage, are available only for this first year of management and thus do not indicate significant trends.

FORAGE CROPS NURSERY. C. H. Moran, H. J. Murphy, W. C. Libby. Plantings were made in the spring of 1949 in the nursery at Rogers Farm in Stillwater, Maine, consisting of 10 selections of orchard grass, 8 of perennial rye grass, 2 of tall oat grass, 3 of Reed canary grass, 7 of smooth brome, 8 of timothy, 6 of meadow fescue, 11 of medium red clover, 2 of alsike clover, 15 of ladino clover, and 50 of alfalfa. During the 1949 growing season no obvious differences were apparent between different varieties of the same forage plants.

IRRIGATION OF HAY AND PASTURE SEEDINGS. R. A. Struchtemeyer, H. J. Murphy. An area that had been seeded down in 1948 to a mixture of red clover, alsike, timothy and red top was divided into irrigated and non-irrigated plots. Plant samples that were taken June 13 prior to any applications of supplementary water showed that all the plots yielded very uniformly and contained about an equal amount of legumes. On the 16th of August the second samples were taken after 4 inches of water had been applied to the irrigated plots. At this cutting, the irrigated plots produced better than twice as much dry matter and contained a higher proportion of legumes than the non-irrigated plots.

INFLUENCE OF SOIL FERTILITY AND MOISTURE UPON FORAGE CROPS. C. H. Moran, S. C. Junkins. Working cooperatively with the Soil Conservation Service and the Regional Pasture Laboratory, U. S. Dept. of Agric., the soils on 18 dairy farms in Central Maine were mapped, and top and sub soil samples taken on all forage crop fields. These samples were analyzed for both chemical and physical composition during the winter of 1949-50 by the Regional Pasture Laboratory at State College, Pennsylvania. The data have not been summarized and correlated with yields and management practices.

UTILIZATION OF RADIOACTIVE PHOSPHORUS BY CLOVER.* G. L. Terman, P. N. Carpenter. In a greenhouse pot experiment with medium red clover, the effect of liming upon the uptake of phosphorus from a virgin and a cultivated Caribou loam was measured by the use of radioactive phosphorus. The virgin soil tested low in available phosphorus and the cultivated soil high as a result of accumulation of phosphorus residues from fertilizer applied for potatoes. The pH of the soils was 5.2 and 5.0, respectively.

Liming markedly increased the growth of clover and uptake of phosphorus on both soils, but increased the use of the phosphorus applied in this experiment on the low phosphorus soil only. On this soil about one-fourth of the phosphorus in the clover was found to have been taken from the fertilizer applied at the rate of 100 pounds P_2O_5 per acre, while nearly one-half was taken from the fertilizer at the 200-pound rate. On the unlimed high-phosphorus soil only about 15 per cent of the phosphorus came from the fertilizer, and practically none for the limed soil.

These results indicate that adequately limed potato soils having high levels of available phosphorus may supply phosphorus for good yields

* Cooperative study with Div. Soil Management and Irrigation, Bur. Plant Industry, Soils and Agr. Engineering, U. S. Dept. Agr.

Financial assistance was given this project by the Fertilizer Industry Committee on Radioactive and Tagged Element Research.

of clover and small grains for several years without further phosphorus fertilization.

CLOVER LEAF MEAL. M. E. Highlands, J. S. Getchell, B. E. Plummer, Jr., J. M. Banton, E. J. Kelley. Samples of dried Mammoth clover and crimson clover have been prepared and analyzed. Dried clovers or clover leaf meals evidently can be produced within the State equal or superior to similar commercial imported materials.

Analyses of these two dried clovers are as follows:

	Moisture	Protein	Carotene, ppm
Mammoth	12.4%	19.9%	319
Crimson	10.8%	18.5%	280

LIGNIN AND CELLULOSE CONTENTS OF MAINE GROWN GRASSES AND LEGUMES. B. E. Plummer, Jr., Judith M. Banton. The usual feed analyses include determinations of moisture, protein, fat, crude fiber, and ash, which are then added together and subtracted from 100 to obtain what is known as nitrogen-free extract. The crude fiber is supposed to contain the more indigestible carbohydrates. The nitrogen-free extract is supposed to represent the more easily digested carbohydrates but may contain considerable lignin which is indigestible. The division of carbohydrates into lignin, cellulose, and "other carbohydrates" by difference has been suggested as a more valuable method of representing the carbohydrates of a feed than the usual determinations of crude fiber and nitrogen-free extract.

The average per cent carbohydrate composition of 36 samples of legumes and 24 samples of grasses commonly grown in Maine by both types of analysis is as follows:

Type of samples	Usual Method		Suggested method			Total carbo-hydrate
	Crude fiber	N.F.E.	Lignin	Cellulose	Other carb.	
36 legumes	23.27	41.43	7.78	25.27	31.65	64.70
24 grasses	33.19	44.68	8.87	41.66	27.24	77.77

There was no large difference between the crude fiber and cellulose content of the legumes, but the nitrogen-free extract was about ten per cent higher than the other carbohydrates by the suggested system of analysis. This suggests that probably most of the lignin as well as some cellulose is included in the nitrogen-free extract.

The cellulose content of the grasses is considerably higher than the crude fiber content and much higher than the cellulose content of the legumes. This is probably due to the higher xylem content of grasses. The difference between the nitrogen-free extract and the other carbo-

hydrates by the suggested system of analysis is much greater with the grasses than the legumes. It would seem that a considerable amount of the cellulose and probably much of the lignin of the grasses are included in the nitrogen-free extract fraction.

The lignin content of both legumes and grasses increased as the plants reached maturity. In some of the young plants the lignin content was as low as four per cent while many of the mature plants contained nearly thirteen per cent.

CAROTENE, RIBOFLAVIN, AND THIAMIN CONTENT OF MAINE GROWN GRASSES AND LEGUMES. B. E. Plummer, Jr., Judith M. Banton. The average composition of the fresh material for six samples of legumes and seven samples of grasses, on a dry weight basis, is as follows:

Vitamin	Legumes		Grasses	
	Vitamin content in ppm	Per cent loss in drying	Vitamin content in ppm	Per cent loss in drying
Carotene	404	13	432	0
Riboflavin	19.5	16	16.3	0
Thiamin	9.4	41	6.6	24

There was no large difference in the vitamin content of the fresh material for legumes and grasses, but the legumes lost more of their vitamin content on drying. The percentage loss of thiamin that occurred in drying was large with both grasses and legumes. These samples were taken in the late fall but represent young growth.

FORESTRY

INCREASED PRODUCTION OF NORTHERN WHITE PINE. R. I. Ashman, F. K. Beyer, C. O. Dirks, G. L. Chapman, F. B. Knight.* An observational check of central, southern, and western Maine showed light white pine weevil damage to young white pine stands during the past ten years. In the summer of 1949, weeviling was approximately 5 per cent in Kennebec, northern Waldo, Androscoggin, and Cumberland counties. However, attacks continued to be severe in the Moosehead Lake region.

A first year survival check on white pine spacing plots established last year showed heavy losses ranging from 8 to 45 per cent. The chief cause of this mortality was frost heaving during the open winter. Measurements of growth are being continued for the white pine plantings in Maine.

* Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

Fertilizer test plots have been set up to show the effect of fertilization on tree growth, and on the occurrence of and recovery from insect attacks.

Plots also have been established in a mature stand of white pine in Liberty to study the effect of partial cutting on the residual stand and on future reproduction.

SPRUCE BUDWORM. C. O. Dirks.* The spruce budworm infestation increased in area and intensity of abundance in 1949. Over a wide area in the northern part of the state noticeable defoliation was observed during the summer. However, in only small areas, of a few acres each, have trees been heavily defoliated and none have been killed. Serious damage is not expected in 1950.

Natural controls were studied in 9 widely separated areas in the northern half of Aroostook County. Detailed collections were made 5 times during the season of insect parasites and insect predators that attack all the different life stages of the budworm. Aggregate parasitism at the 9 collection plots varied between 50 and 76 per cent. This degree of parasitism averaged only about 10 per cent lower than that observed in the Adirondacks of New York when the spruce budworm dropped from a high to a very low infestation. The common parasites found in the Adirondacks were present in Maine in 1949.

EFFICIENT MANAGEMENT OF SMALL WOODLOTS. R. I. Ashman, G. L. Chapman, Roger Taylor. Additional thinning plots have been established on the University Forest, for which time studies were made. Experiments also have been started on the time involved and the effectiveness of girdling and poisoning worthless trees. The results are not yet available.

SEASONING OF MAINE WOODS. Gregory Baker, Frank K. Beyer. A preliminary study of kiln brown stain of white pine, otherwise known as chemical brown stain has been made. This seasoning defect causes considerable degrade of the finish grades of white pine lumber, but its exact cause is not known.

Five kiln charges were run. The first three were 3-inch pine plank, the fourth of 1-inch pine boards, and the fifth of $1\frac{11}{16}'' \times 2\frac{5}{8}''$ bars. Moisture content conditions ranged from material seasoned about 3 months to stock green from the saw.

All results to date have been negative, but work will be continued to segregate the factors contributing to this defect. The length of time

* Supervision of research upon the spruce budworm is directed by the Div. Forest Insect Investigations, Bur. Entomology and Plant Quarantine, U. S. Dept. Agr. R. C. Brown, H. J. MacAloney, and P. B. Dowden, New Haven, Connecticut, are the administrators of the different phases of the work.

the logs are stored before sawing, whether the logs are stored in dry or water storage, the time of year the logs are cut, and the method of storing the lumber prior to kiln drying may be contributing factors.

GRAIN

SMALL GRAIN TRIALS.* S. C. Junkins. Twenty-six varieties of oats, fifteen varieties of barley, four varieties of spring wheat, and eight varieties of winter wheat were tested during 1949. The most desirable varieties of oats from the standpoint of yield and disease resistance are Clinton, Ajax, Abegweit, Bonda, and Roxton. Plains barley is the most productive named variety, and several unnamed varieties also show promise of good yielding ability. Nured has been the most productive winter wheat variety at Aroostook Farm, with Dawson and Ottawa 2619A being most productive at Highmoor Farm. Frondoso, a late variety of spring wheat, has yielded best for the past three seasons, followed by Rio Negro and Frontana. The results of the trials have been summarized in Mimeographed Report No. 10, Cooperative Small Grain Trials in Maine, 1949.

CHEMICAL WEED CONTROL IN OATS. M. F. Trevett, Robert Littlefield. At temperatures of 85° F and above, dinitro selective weed killers (13%) severely injured oats, and unless the weed infestation was large some reduction in yield resulted. Concentrations should be adjusted to prevailing temperatures according to the directions on container labels which recommend 3 quarts of the concentrate per acre for a temperature of 65-80° F, 4 quarts per acre if below 65° F, and 2 quarts per acre if above 80° F.

HOGS

COMPARISON OF PLANT AND ANIMAL PROTEINS FOR GROWING SWINE. H. C. Dickey, H. W. Hall. In this study, pigs fed an animal protein of meat and bone scrap gained 210 pounds per pig, requiring 402 pounds of feed per 100 pounds gained. The pigs fed a plant protein of soybean oil meal gained only 166 pounds per pig, using 398 pounds of feed per 100 pounds gained. Because the animal protein cost 53 per cent more than the plant protein, the feed cost per 100 pounds of gain in weight was \$16.43 for the animal protein as compared with \$12.60 for the plant protein. In both lots, the pigs received a balanced ration, with the protein feed supplemented by 15 per cent alfalfa meal, hominy feed, minerals, and cod liver oil.

* Cooperative project with Div. Cereal Crops and Diseases, Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.

HOME ECONOMICS

WORKING AND STORAGE SPACES NEEDED IN RURAL HOMES.* Merna M. Monroe. The summary of the uses of rooms gives an idea of the working and storage spaces needed in rural houses. However, these homes are often inadequately heated and inconveniently arranged which may affect the present use.

The kitchen was used for a wide variety of activities. It was used for a dressing room for the children not only during the winter, but also for preschool children during the summer, bathing very young children, washing children's faces and hands, combing the daughter's hair, and drying wet wraps and other clothes during the winter. Preschool children did much of their winter-time playing in the kitchen, including tricycle riding. Young school-age children studied here, played table games, and worked on activities that required a worktable surface. Nearly half of the mothers and a third of the fathers did their desk work here. Sewing was done here in about a third and reading in about a fourth of the homes. The kitchen also was sometimes used in the winter by the part-time farmer to repair tools or machinery. This extensive use of the kitchen may be due not only to other rooms being inadequately heated or furnished, but also to the need for the mother's supervision in or near the kitchen, the desire for sociability especially by young children, and the fact that the kitchen may be the most cheerful room of the house because of its location and decoration.

The living room and dining room were used for young children's play in a fourth to less than half of the homes. Adolescents used the dining room for studying, table games, work on scrapbooks, and reading. Relatively few preschool children did much playing in their bedrooms, but in about a third of the homes the young school child played there. Adolescents used their bedrooms for working on collections, making boats, studying and reading, in addition to sleeping.

Children dressed in the bathroom in about a third of the homes that had first-floor bathrooms.

The mother also was asked where she would provide space for certain activities if she could plan a house as she wanted it. About half of the mothers of preschool and of young school children wanted a playroom, a fourth of the mothers of preschool children would have them play in their bedrooms, and a third of the mothers of young school children would have them play in the basement. The majority would use

* This study supplements a cooperative survey made in 1948 as a Northeast regional project, the results of which were published by the Cornell University Press as Northeast Regional Publication No. 1, "Farm Housing in the Northeast."

the basement or a porch for children's vigorous play during bad weather. Nearly half of the mothers of young children said they would dress them in the first-floor bedroom. Only a fourth of the mothers with young children asked for a type of bathing facility that is at work-counter height in place of a bathtub. Sitting room space for other members of the household while the living room was being used for entertaining, was most frequently indicated to be the "den" or the "kitchen."

Three house plans which showed furniture and equipment for dual or multiple uses of certain rooms were presented and described to those homemakers who could read floor plans (about a third of them could).

FIGURE 6. One-half or More of the Families Having Children 5½ to 12 years Old Had the Toys Shown Here.

The most commonly occurring number was 4 cuddly dolls or stuffed animals, 4 "hard" dolls, 5 table games, 6 puzzles, a set of doll-house furniture, 7 miniature "trucks," 6 "trucks" that are from 6 to 17 inches long, 1 train on tracks, 1 "truck" that is 18 to 36 inches long, tinker toy, ball bat and glove, doll bed, doll carriage, and an ironing board or a bathinette. Not shown here are: 2 sleds, 1 wagon, 1 tricycle, 1 bicycle for children 7 to 12 years old, 2 pairs skis, 1 blackboard, 1 child's table, 2 childrens' chairs, and 4 buildings cut from cereal boxes.



The mother was then asked which plan she liked best for different activities. Nearly all of these mothers, many of whom had previously said they would have children play in their bedrooms, now liked the plans which provided for play in the utility room or in the family activities room. The utility area was separated from the kitchen by a peninsula which permitted the mothers to see the children but blocked the area off from the rest of the house. The family activities room was liked because it gave easy access to the kitchen, bathroom, outside doors, and bedrooms, was away from the living room, and served as a sewing room and a second sitting room. There was a tendency to prefer a company dining area that could be closed off from the living room. There was a pronounced desire for having the washing machine out of the kitchen. Most of the women preferred having the rear entrance open into a vestibule, a rear hall, or a utility room, rather than entering directly into the kitchen. No one wanted traffic from the rear door of kitchen to go through the dining or living area en route to the bathroom.

STORAGE SPACE FOR CHILDREN'S TOYS.* Merna M. Monroe. An inventory was obtained of the kinds and numbers of toys possessed by 190 Maine rural families. This information has been summarized as a guide in designing adequate storage space for children's toys (Figure 6).

Types of storage, such as chests, open shelves, cupboards, and drawers, were evaluated by observing the ease with which preschool children could get out and put away their toys. Boxes or chests with a lid are not suitable as a general storage for several varieties of toys. On the other hand, shelves are suitable for a great variety of toys because the child can see what he has and can get out a toy without disturbing other possessions. Cupboard doors appeared to be no hindrance. These children had no trouble with drawers that were relatively narrow and equipped with one handle instead of two. Children 4 years old or older successfully stored books in a magazine rack and in a vertical, "pan-lid" file, but younger children managed these better by laying them on a shelf. An open box on wheels was most popular for collecting and storing building blocks, although small canvas bags were acceptable.

DIETS AND NUTRITION OF JUNIOR HIGH SCHOOL PUPILS AND ADULTS.† Mary M. Clayton, Dorothy U. Turner, Prudence S. Higgins,

* This study is a subproject of the cooperative Northeast regional study, "Space Facility and Structural Requirements for Farm Homes in the Northeastern Region."

† Cooperative northeast regional study including experiment stations of Maine, Mass., New York, Rhode Island, New Jersey, and West Virginia. The physicians who assisted with the study are Dr. W. B. Manter, Dr. S. L. Wagner, and Dr. Harland Turner. The Maine Extension Service cooperated in making the adult blood tests.

Ruth Goff, Elaine Fogler. Thus far the Maine study has included physical examinations by physicians, diet studies and blood tests on 780 junior high school students from Bangor, Bucksport, Newport, and Skowhegan; and blood tests on 185 adults from all counties in Maine (Figure 7).



FIGURE 7. Maine Farm Leaders Receiving Nutritional Blood Tests During Farm and Home Week.

The junior high school students in all towns showed similar types of nutritional defects. These included underweight; signs of previous rickets; rough, dry "goose pimply" skin; reddened, peeling lips and cracks and sores at the corners of the mouth; changes in the surface of the tongue; inflamed gums; and decay of the teeth. Underweight, reddened peeling lips and inflamed gums were seen more often in the boys than in the girls.

The results of the blood tests indicated that the most outstanding deficiencies were in carotene and vitamin C. In carotene 85 per cent of the junior high school students and 49 per cent of the adults were below normal. In vitamin C 69 per cent of the boys, 48 per cent of the girls and men, and 35 per cent of the women were low. In vitamin A, about 40 per cent of the students, none of the men, and 9 per cent of the women were below standard. In hemoglobin, approximately 40 per cent of the students, 10 per cent of the men, and 20 per cent of the women were

below normal. The poorer showing of the junior high school students is no doubt partly due to the fact that children of this age have much higher food requirements than adults. Also, most of the adults were members of Farm Bureau groups or Extension Service personnel who probably give more attention to their diets and spend more for their food.

Since blood tests showed vitamin A deficiency to be much less frequent than carotene deficiency, it is probable that many persons were receiving most of their vitamin A from foods such as cream, butter, eggs, and liver. These are good direct sources of vitamin A, whereas green and yellow fruits and vegetables supply carotene which must be absorbed into the blood and later changed to vitamin A.

The diet records of the school children showed a definite need for greater consumption of foods high in carotene, such as green and yellow vegetables and yellow fruits, and for foods high in vitamin C such as citrus fruits, tomatoes, and raw cabbage. Need was also shown for the use of more milk and other foods which supply animal protein. Insufficient milk was used by more than half of the children. In Bucksport, Newport, and Skowhegan the girls drank considerably less milk than the boys. Most of the diets were high in sweets, which no doubt was one reason for considerable decay of the teeth.

MELONS

VARIETY TRIALS WITH MELONS. E. F. Murphy, Lyle Littlefield. Delicious and Golden Champlain were more palatable than Earliest Ripe and Far North Muskmelons. All 4 of these varieties produced equally well at Orono by mid-September.

Honey Cream, Early Canada, and Sweet Siberian watermelons yielded better at Orono than 4th of July, Salzer's Earliest, and Northern Sweet. Honey Cream and Sweet Siberian were highest in palatability, and were significantly better than 4th of July.

Among numerous varieties of watermelons tested at Highmoor Farm, N. H. Midget, Merrimack Sweetheart, and Sweet Siberian were the earliest and most prolific. The latter is a yellow fleshed variety.

PEAS FOR PROCESSING

FERTILIZER TESTS ON PEAS.* C. E. Cunningham, G. L. Terman, H. J. Murphy, M. F. Trevett, James West. As in previous years, nitrogen applications increased the growth of vines markedly and the yield

* The test at Hartland was a cooperative project with H. C. Baxter & Bro. The tests in Aroostook County were in cooperation with the Bird's Eye-Snider Division, General Foods Corporation

of shelled peas to a lesser extent. The average yield of shelled peas per acre for no nitrogen and for 45 pounds of nitrogen, for the same tenderometer reading, were as follows (pounds per acre):

	Aroostook Farm	Crouseville	Hartland
No nitrogen	2160	2580	2570
45 pounds N.	2440	3370	2800

Larger amounts of nitrogen than 45 pounds did not result in further yield increases. The 45 pound rate at Hartland held the peas in a high quality condition one day longer, while yields increased 200-265 pounds daily per acre. Fertilization with phosphorus and potash had no effect on yields.

POTATOES

The potato research program has become increasingly effective with the use of Potato Tax funds. During 1949-50, a total of \$55,000.00 was allotted to research by the Potato Tax Committee from the one cent per barrel tax. These funds assisted in financing the following projects, which are summarized in this section:

Control of Aphids Through Use of Insecticides.

Weeds and Other Secondary Host Plants as a Source of Aphid Infestation to Potatoes.

Relation of Aphid Population and Leafroll Content of the Seed to the Spread of Leafroll During the Summer.

Development of Leafroll Resistant Varieties.

Development of Strains of Seed Potatoes That Are Free of Latent Mosaic and Certain Other Tuber-Bourne Diseases.

Potato Variety Trials.

Control of Potato Tuber Size.

Soil Fertility in Central Maine.

Potato Top Killing and Chemical Control of Weeds in Potato Fields.

Wireworm Control.

Engineering Studies.

Storage, Grading and Packaging Maine Potatoes.

Potato Products, Including the Use of Starch Plant Waste.

CONTROL OF APHIDS AND LEAFROLL SPREAD. Tests of Insecticidal-Fungicidal Mixtures. W. A. Shands,* G. W. Simpson, R. M. Cobb,

* Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

P. M. Lombard.* Weekly applications of DDT as an emulsion, in a spray containing yellow cuprous oxide to Chippewa potatoes having 3 per cent of the planted seed pieces infected with leafroll, substantially reduced the seasonal spread of leafroll. This resulted from the control of wingless aphids that could otherwise have spread leafroll from plant to plant within the plot. This application of 0.63 pound of DDT per acre per application had no significant effect on the yield of potatoes harvested prior to August 31. Aside from aphid control, DDT apparently had no stimulating effect upon the plants.

The reduction in leafroll spread, without roguing of chronic leafroll, was not sufficient to permit seed growers to rely on DDT alone to provide high quality seed for replanting for certification, but it was sufficient in the experimental plots to provide seed suitable for planting table stock fields. In 1949, however, there were relatively few flying green peach aphids present in these plots or in adjacent fields. Had there been large numbers of winged aphids present, the reduction in the leafroll spread by wingless aphids might well have been nullified.

Differences in yield of Katahdin potatoes were not significant between treatments following weekly applications of 4 dust mixtures and 3 spray mixtures containing various combinations of aphicides, with yellow cuprous oxide as a fungicide in each mixture. The dust mixtures contained, respectively, 5 per cent DDT, 2 per cent DDT with 2 per cent oil, 1 per cent DDT with 4 per cent oil, and an impregnated DDT mixture containing 1 per cent DDT and 4 per cent oil. In each 100 gallons of finished spray, the 3 spray mixtures contained, respectively, 0.5 pound of DDT in an emulsion, 0.15 pound parathion from 15 per cent wettable powder, and 0.075 pound of parathion from 15 per cent wettable powder. All of the treatments gave good to excellent control of the aphids. Although there were some differences in degree of aphid control, the differences were neither consistent nor great enough to affect yield.

Additional Tests of Insecticidal-Fungicidal Mixtures. G. W. Simpson, W. A. Shands,† R. M. Cobb, F. S. Roberts. The weekly application of toxaphene emulsion or of rotenone from ground derris root, applied with yellow cuprous oxide, resulted in less effective aphid control than did the use of DDT as an emulsion or in suspension, or of toxaphene in suspension. There was some possibility of plant injury from the use of the toxaphene emulsion. The per-acre application rate of DDT was 0.63 pound in emulsion and 2.5 pounds in suspension; that of toxaphene was 0.075 pound in emulsion and 0.075 pound in suspension.

* Cooperative study with Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.

† Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

phene was 0.78 pound in emulsion and 1.88 pounds in suspension; while that of the rotenone was 0.25 pound per acre.

Preliminary relative-toxicity tests in field plots in 1949 gave indications that the choice of an oil solvent for a DDT-impregnated fungicidal dust may influence aphid control sufficiently to increase yields. The dusts used in the test contained yellow cuprous oxide, 1.8 per cent DDT and 4 per cent oil. Considerable promise was found, from the standpoints of aphid control on potatoes and of increased tuber yield, for machinery that will impregnate fungicidal dust mixtures during application with a DDT-oil concentrate. The application of concentrated insecticide-fungicide mixtures using far fewer gallons per acre than is customary may provide satisfactory aphid control.

Time of Dust Applications. W. A. Shands,* G. W. Simpson, R. M. Cobb, F. S. Roberts. When begun in late June, weekly applications of a dust mixture containing 6 per cent of yellow cuprous oxide, 3 per cent of DDT and 4 per cent of oil gave excellent aphid control on Katahdin potatoes, as long as the application of DDT was continued. Aphid populations built up slightly, however, before the end of the season in plots where the last application of DDT was made on July 20 or on August 3. There were no consistent differences in yield, however, from plots where DDT treatments were stopped at 5 different dates between July 20 and frost. The results emphasize the value in aphid control of beginning thorough applications of insecticides early in the season.

No differences in leafroll spread, due to date of discontinuing DDT applications, were found in a similar experiment involving the application of DDT dusts and sprays to Katahdin potatoes in 1948.

Relation of Aphid Populations to Leafroll Spread and Potato Yields. G. W. Simpson, W. A. Shands,* R. M. Cobb, F. S. Roberts. The amount of leafroll spread in the Chippewa variety was found to be related positively to the number of aphids on the plants during the summer and also to the abundance of potato plants having chronic leafroll that were not removed from the plots. The yield of Chippewas was decreased with an increase in the numbers of aphids found on the plants even though this variety is less severely affected by aphid feeding than are some other varieties.

THE FLORIDA TEST. G. W. Simpson, W. F. Porter,† E. L. Newdick,† R. M. Cobb. From the 1949 crop, growers sent 1171 samples

* Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

† Cooperative project with Div. Plant Industry, Maine Dept. Agr.

of potatoes representing the production of seed from 13,856 acres to Florida for a determination of virus content and varietal mixture. The results of the test showed that there was some spread of virus diseases during the summer, but that the increase in infection was not serious as far as certification in 1950 was concerned. Of the total acreage represented, 58 per cent qualified as foundation seed in spite of a change in the official definition of this grade, requiring a reading of 0.5 per cent or less of total virus infection.

The readings in Florida showed a general increase during 1949 in leafroll and in several mosaic diseases, for potatoes from all sections of the State. More samples than usual showed spindle tuber which was the most important disqualifying disease in the Kennebec variety. Fortunately, however, only 3 per cent of the total acreage represented by samples was found to be unfit for further propagation. A fair percentage of this amount was due to varietal mixture rather than to disease.

Of the total acreage represented in the Florida test, 48 per cent was Katahdin, 25 per cent was Chippewa, 11 per cent was Green Mountain, 9 per cent was Irish Cobbler, 2 per cent was Sebago, 2 per cent was Kennebec, and the remaining 3 per cent was of several minor varieties.

WHY THERE WAS INCREASED SPREAD OF LEAFROLL IN 1949. G. W. Simpson, W. A. Shands,* F. S. Roberts. The results of the Florida Test showed that the downward trend in leafroll infection of potatoes which has been recorded for several years was reversed in 1949. The reason for this reversal apparently was that the year 1949 was favorable for aphid development. Weed hosts of the green peach aphid were infested to a greater extent than for some time, which contributed to the increase in winged forms that could move to potatoes in midsummer. Records from the aphid traps showed that there were 8 times as many green peach aphids taken in 1949 as in 1948 and 4 times as many as taken in 1947. Another factor that influenced the increase in the number of aphids in 1949 was the rapid emergence and growth of the potato plants. Many growers waited too long before beginning application of aphicides. Early, thorough coverage of the plants is needed while aphid populations are small, so as to prevent colonies of aphids from becoming established and increasing in size as the plants develop.

Leafroll spread would doubtless have been much more severe if it had not been for the more general use of DDT and other aphicides by growers and the planting of seed relatively free from this disease. The seed planted in 1949 had less disease than that planted for many years, due to the extensive use of certified seed and the discarding of poor seed

* Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

stocks during the past few years. Leafroll spread in potatoes can be kept to a minimum on a community basis by planting healthy seed, controlling weeds on which the aphids multiply, and by effective application of suitable insecticides to the potatoes.

There was no experimental evidence to indicate that the situation in 1949 involved any aphid resistance to DDT.

EFFECT OF APPLICATIONS AND SOIL RESIDUE OF DDT AND TOXAPHENE ON POTATOES AND OTHER CROPS. W. A. Shands,* G. W. Simpson, G. L. Terman, A. S. Getchell. A total of 80 pounds of DDT or 47 pounds of toxaphene per acre, applied to the soil, did not affect the yield of Katahdin or Green Mountain potatoes in small experimental plots. Three fourths of these amounts had been applied to the soil in 1948 and the remainder in 1949. Mixtures of DDT and toxaphene applied in 1948 and 1949 also did not affect the yield of potatoes. The yields of oats and barley were not affected in 1949 by soil applications in 1948 of 60 pounds per acre of DDT or of 32 pounds per acre of toxaphene.

Applications of these materials directly to growing potato plants, at usually recommended rates, resulted in reduced yields only in the case of the toxaphene emulsion. The reduction may have been due to other factors.

Chemical analyses showed no insecticide residues in the 1948 and 1949 samples of potato tubers, or in the 1948 samples of peas, pea pods, and plants of English peas, from plots in which the insecticides had been applied to the soil before planting. Small amounts of insecticide residues were found in some of the soil samples where heavy applications of DDT had been made to the soil and where toxaphene had been applied to the soil or to the growing potato plants.

AN UNUSUAL INFESTATION OF MEALY BUGS ON POTATOES. G. W. Simpson, W. A. Shands.* In midseason, several infestations of mealy bugs occurred in widely scattered localities in potato fields planted near neglected apple orchards. The insect usually involved was tentatively identified as *Phenacoccus aceris* (Sign.) since this was the insect found on nearby apples. Another species of mealy bug, however, was found in several fields of potatoes.

Feeding injury on potatoes by what is believed to be *P. aceris* was often quite pronounced near apple trees but tended to become less at a distance. The feeding injury consisted of small bright yellow spots on the leaves wherever a coccid had been feeding. The injury, which did not appear to affect the plant adversely, could easily be mistaken for acuba mosaic.

* Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

CONTROL OF LEAFROLL. *Testing New Seedlings for Leafroll Resistance.* G. W. Simpson, Reiner Bonde, Donald Merriam, D. F. Akeley. The seedlings that did not show current season leafroll symptoms in 1948 were again inoculated in 1949 with infected green peach aphids. Also tested at Aroostook Farm were 5780 new seedlings received from Beltsville, which were derived from 34 crosses and 2 selfed lines. In previous years, only a relatively few of the first year seedlings have survived leafroll infection. In 1949, however, a larger percentage than usual showed no current season leafroll symptoms, due probably to the use of leafroll resistant parents.

Further Selection of Resistant Seedlings. Reiner Bonde, G. W. Simpson, Donald Merriam. Of sixteen unnamed seedlings previously selected as being resistant to leafroll, four showed no current seasonal symptoms when inoculated with infected aphids in 1949, and apparently are highly resistant. Six other seedlings developed from 8 to 40 per cent diseased plants, and are considered to be resistant under natural field conditions. Six commercial varieties, similarly tested in 1949, were all highly susceptible to leafroll infection.

Testing of Seedlings for Field Resistance to Leafroll. Donald Folsom. The field spread of leafroll in selected seedlings was tested at Highmoor Farm with every third row planted to leafroll. About 25 per cent of the seedlings received in 1947 and 1948 after passing the severe Aroostook Farm aphid-transmission test, contracted the disease at Highmoor Farm, showing that sometimes the field test may be more severe than the aphid test. A number of seedlings that appear resistant to leafroll are being increased and used in breeding resistant varieties that possess high yields, good cooking qualities, and resistance to other diseases.

Resistance in Potatoes to Feeding Injury by Green Peach Aphids. G. W. Simpson, D. F. Akeley. In 1949, a total of 129 seedlings and 2 commercial varieties were grown in cages and infested with wingless adult green peach aphids. Most of these seedlings were easily injured by green peach aphids, and in most cases numerous winged aphids quickly developed. The few seedlings that did not develop large numbers of winged aphids presumably would have less spread of leafroll and would be highly desirable for commercial production, other factors being satisfactory.

Effect of Weed Hosts on Ability of Green Peach Aphids to Transmit Leafroll. G. W. Simpson, Reiner Bonde, D. F. Akeley. Natural infestations of green peach aphids on wild rutabaga, wild radish, hemp nettle, field sorrel and lamb's-quarters were transferred to caged leaves of infected Katahdin potatoes in the greenhouse. As aphids matured on

the caged leaves, the adults were transferred to ground-cherry plants where they were allowed to feed until they had established colonies. The adults were then preserved for a study of morphological characters. Some transmission of leafroll took place regardless of the weed from which the original aphid colony had been taken. Evidently green peach aphids that transfer to potatoes from any of several important weed hosts are potential vectors of leafroll. Mature wingless aphids from all the weeds mentioned above, and also from shepherds' purse and potato plants were determined in the Division of Insect Identification of the Bureau of Entomology and Plant Quarantine as being green peach aphids of similar morphology.

CONTROL OF SPINDLE TUBER. Reiner Bonde, Donald Merriam. The control of spindle tuber has not been a serious problem in Maine for nearly 25 years. However, during 1948 and 1949 this disease appeared in certain seed stocks and has caused considerable concern to some potato growers. Experiments conducted in 1949 confirm previous information that the disease is readily spread by the cutting knife, by seed piece contact and by contact of the young sprouts on the seed tubers. It is thought that contamination of the young sprouts on seed tubers is one of the chief factors in the spread of this disease. Rapid drying of the seed pieces before they were planted eliminated most of the spread by contamination. The spread also apparently could be reduced by treating the freshly cut seed in disinfecting solutions.

CONTROL OF BLACKLEG. Reiner Bonde, Donald Merriam. Seed tubers harvested from blackleg plants in 1948 produced no disease when planted in New Jersey, and only a trace of the disease when planted in Aroostook Farm. Injury of freshly cut infected seed stocks by exposure to dry air and sunlight increased the percentage of blackleg in the Seabago variety. The results of many years' experiments have been summarized in Station Bulletin 482, "Factors Affecting Potato Blackleg and Seed Piece Decay."

CONTROL OF LATENT MOSAIC. Reiner Bonde, Donald Merriam. The percentage of latent mosaic in samples of 34 farmers' seed stocks from Aroostook County varied from 2 to 98 per cent. The yield rates were decreased in direct proportion to the percentage of latent mosaic in the seed stocks.

Approximately 14,000 seed tubers were indexed in the greenhouse at Presque Isle for the purpose of obtaining seed stocks free of this disease. The healthy tubers obtained by the indexing work were planted at Masardis for increased production for the Foundation Seed Program.

CONTROL OF RING-ROT. Reiner Bonde, Donald Merriam. Approximately 13,000 selected seed tubers were indexed in the greenhouse to

obtain strains free of ring-rot and other tuber-borne diseases. The disease-free seed tubers were planted by the tuber unit method at the Masardis farm for increase. The crop from 30 acres of ring-rot free Katahdins originating from greenhouse indexed seed stocks was distributed to farmers under the Foundation Seed Program in 1949. About 350 samples of farmers' seed potatoes also were examined for ring-rot.

Actidione (Streptomycin), an antibiotic material, destroyed the ring-rot bacteria on cut potato seed pieces when used at very high dilutions. This material, however, injured the cut seed pieces and reduced the emergence considerably.

Exposure of contaminated cut seed stocks to sunlight and air circulation reduced the amount of ring-rot infection from 100 per cent in the controls to only 15 per cent in seed that had been exposed. Sunlight possibly may be a useful agent in the sterilization of machinery and equipment used for harvesting and marketing the potato crop. The organism has been found to remain viable for long periods of time in dark storage bins or other protected places. Greening seed stocks did not reduce the amount of ring-rot infection.

Five seedling varieties derived from crosses with the wild potato (*Solanum demissum*) were found to possess resistance to ring-rot infection and also late blight. Approximately 291 desirable selected seedlings from resistant parents also were tested for resistance to the disease. Some of these better seedlings were found to be very resistant to ring-rot besides having desirable marketing qualities. About 2500 unselected seedlings, the progenies of 12 crosses, were inoculated with ring-rot bacteria for the purpose of learning more about the inheritance of resistance to this disease.

CONTROL OF POTATO BLIGHT. Reiner Bonde, J. A. Robinson. Late blight did not become prevalent in 1949 until after September 10, when most farmers had stopped their spraying program for the season. The result was that considerable loss from late blight tuber rot occurred in some fields, especially in certain fields that had received dust applications with the helicopter. Although late blight was relatively unimportant in most farmers' fields, data were obtained on the fungicidal value of the different fungicides included in the experiments conducted on Aroostook Farm in 1949.

Some plots received applications of organic fungicides throughout the season and similar plots received the same fungicides until late blight appeared and then were changed to Bordeaux until the end of the season. Shifting to Bordeaux reduced the yield rate slightly for Dithane, Parzate, and Zerlate. This reduction in yield rate, however, was not significant and further experiments may prove that it is ad-

visible to supplement the organic spray materials with Bordeaux in years that are favorable for late blight. Bordeaux is a cheap fungicide which controls late blight under severe conditions but under normal conditions results in smaller yields than the organic spray materials.

COMPARISON OF DIFFERENT FUNGICIDES FOR POTATOES.* Reiner Bonde, J. A. Robinson. Tribasic copper sulphate combined with zinc (Cop-O-Zink), and copper zinc chromate ("Crag") produced the highest yield rate of 220 barrels per acre, followed by Parzate with 218 barrels per acre. These and four other standard spray fungicides gave complete control of late blight. Bordeaux and Parzate (with zinc sulphate) gave the best control of early blight, followed by copper zinc chromate, tribasic copper sulphate, and Dithane D14 (with zinc sulphate) in the order of decreasing effectiveness.

Two newly developed spray fungicides (thiocyanate and hydrocarbon compounds) improved the yields in one test more than did the standard Bordeaux and tribasic copper sulphate treatment. These organic fungicides, however, failed to give complete control of late blight. A mercury and copper containing compound (Puratized 111-5) gave good yields and control of early and late blight. All of the above fungicides were compatible with DDT.

Three pounds of copper nitrodithioacetate combined with one pint of 25 per cent DDT and 3 per cent parathion emulsion in 100 gallons of spray mixture improved the yield rates considerably and gave excellent control of the blight diseases and of insects. A spray mixture consisting of one pound of parathion in 100 gallons Bordeaux also gave excellent control of the diseases and insects, with high yield rates. The latter spray mixture was significantly superior to Bordeaux, and tribasic copper sulphate, both in combination with DDT. Parathion in combination with a fungicide decreased the amount of early blight infection more than DDT with the same fungicide.

Tribasic copper sulphate talc dusts containing 7 per cent copper and either 5 per cent DDT or 1 per cent Parathion resulted in significantly greater yields than zinc copper chromate talc dusts containing 6 per cent copper and 3 per cent DDT. The dust containing 1 per cent Parathion resulted in better yields, only about one-third as many aphids, and reduced the amount of early blight, as compared with same dust containing 5 per cent DDT.

Zinc sulphate added to the copper spray fungicides and to the soil about the plant did not improve the yield rate or stimulate the plant

* Financial assistance was given these experiments by General Chemical Company, E. I. du Pont de Nemours Company, and Tennessee Corporation.

growth. Zinc sulphate, however, did increase the yield rate significantly when added to Dithane (D-14) and Parzate spray mixtures.

A newly developed cuprous oxide powder* containing 90 per cent metallic copper blended with Talc and DDT proved to be equal to the standard cuprocide and tribasic copper sulphate talc dusts for the control of early blight, late blight and insects. This cuprous powder is said to be a cheaper source of copper fungicide than other similar fungicides being offered for sale.

In 1949, the impregnated dusts using 1.5 per cent DDT in oil resulted in higher yields than Dithane Z-78, Cuprocide, or tribasic copper sulphate dusts. This increase in yield rate apparently was not caused by better control of aphids but by a reduction in the amount of early blight infection. Late blight was controlled by all of the fungicides included in the test.

In 1949, there was no significant difference in yield rate for dust as compared with spray applications of fungicides. The use of DDT with the fungicides increased the yield rate 32 barrels per acre (16 per cent) with spray applications, and 22 barrels per acre (10 per cent) with dust applications.**

BEST TIME OF DAY TO APPLY DUST FUNGICIDES. Reiner Bonde, J. A. Robinson. There was no significant difference in the yield between fields dusted in the morning while the plants were moist and the air was quiet, and those where the applications were made in the middle of the day while the plants were dry and the wind was blowing. The best control of aphids was obtained when the applications were made to dry foliage in the middle of the day. The best control of early blight was obtained when the dust applications were made in the morning to moist foliage.

DETERIORATION AND PHYSICAL BREAKDOWN OF POTATOES IN TRANSIT.† Donald Folsom, H. Q. Roach.‡ In May, 1949, mahogany browning showed some increase in transit between Aroostook County and New York City. Tubers with mahogany browning were larger than the average, and the larger tubers had a greater proportion of internal tuber tissue affected.

In the 1949 crop, occasionally from a third to a half (by weight) of the clear-fleshed tubers developed net necrosis in transit, but usually

* A cuprous oxide-talc dust containing 6 per cent metallic copper and 5 per cent DDT supplied by H. H. Robertson Co., Pittsburgh, Pennsylvania.

** One barrel of potatoes is equivalent to 2.75 bushels.

† Cooperative project with Div. Markets, Maine Dept. Agr., and with Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.

‡ Cooperative agent, Div. Markets, Maine Dept. Agr.

the only change in net necrosis or stem-end browning was an increase in the proportion of waste tissue.

Usually there was some increase in transit in the percentage of tubers showing ring rot, both externally and when examined internally. Occasionally there was a significant increase.

The proportion of stock showing late blight always decreased in transit, probably because of drying out of the diseased tubers. Such stock, however, always showed a significant increase in soft rot. Associated blight-free tubers also developed soft rot.

One-third to one-half of the healthy stock "cleaned" with rubber brushes and sawdust developed bruises or lesions in transit.

For 20 shipments the average time in transit to New York City was 7 days and the average temperature in the bagged potatoes in transit was 50° F. For 22 shipments in 50-pound bags, the average loss in transit was 0.7 pound. The drop in weight was nearly twice as much in samples selected for late blight or for rubber-brush cleaning, than in the other samples.

POTATO VARIETY TESTING. W. C. Libby, R. V. Akeley,* S. C. Jenkins, G. W. Simpson, Donald Folsom, Reiner Bonde. Twenty potato varieties were grown at six Maine locations in 1949. The six leading varieties on the basis of yield were, in order, Ontario, Essex, Pontiac, Kennebec, B76-43, and Green Mountain. Of these six varieties the Kennebec, B76-43, and the Green Mountain were of satisfactory quality as measured by specific gravity.

Working cooperatively with H. C. Baxter and Bro., unlabeled sample lots of the twenty varieties were made into french fries and frozen. Quality control personnel of the Baxter organization rated the varieties as to their acceptability.

Based on these trials, four of the six highest yielding varieties, Kennebec, B76-43, Green Mountain, and Essex, yield frozen french fries equal in quality to the Katahdin.

COMPARISON OF DATE OF PLANTING ON YIELD AND PERCENTAGE OF U. S. NO. 1 TUBERS FOR EIGHT VARIETIES. Reiner Bonde, Donald Merriam, R. V. Akeley.* Chippewa, Green Mountain, Irish Cobbler, Katahdin, Kennebec, Mohawk, Sebago, and Teton potatoes were planted on the dates of May 3, May 12, May 26, and June 6, 1949. The best planting date from the standpoint of yield was May 12. The eight varieties planted on this date yielded on the average 43 barrels per acre, or 27 per cent, more U. S. No. 1 tubers than the same varieties planted on June 6. Kennebec ranked first in yield in all four plantings and

* Cooperative study with Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.

Irish Cobbler ranked last except in the plots planted May 26 where Sebago ranked last. Kennebec planted June 6 had only 96 days to grow, but yielded at the rate of 177 barrels per acre compared with only 121 barrels for Irish Cobbler. The proportion of U. S. No. 1 tubers was about the same for all dates. The highest specific gravity and best cooking quality resulted when potatoes were planted May 3 to permit a long growing season. Green Mountain, Irish Cobbler, Mohawk, Kennebec, and Teton had a specific gravity of 1.080 or higher and possessed excellent baking qualities. Chippewa, Katahdin, and Sebago, when planted on May 3, had specific gravities of 1.073 or better, and possessed good baking and excellent cooking qualities.

FIELD STAND OF POTATOES. S. C. Junkins. In general there were no important differences in total yield of potatoes with stands of 100, 75, 67, 60, and 50 per cent, when potatoes were planted 5, 7, and 9 inches apart. The wider spacing and missing hills resulted in an increase in tuber size.

A farm survey was made in Central Maine and in Aroostook County to determine the causes of missing hills and to determine the spacings between seed pieces which are used in commercial fields. The average seed spacing within the row was 9.1 inches in Central Maine, and 7.9 inches in Aroostook County. Central Maine farmers had an average stand of 89.3 per cent, with an average stand of 94.9 per cent for Aroostook County. The major cause of missing hills in both areas was no seed piece, with the second major cause of misses being seed with no eyes.

EFFECT OF SEED SPACING, IRRIGATION, AND THIOUREA ON SIZE AND YIELD OF POTATOES.* G. L. Terman, W. C. Libby, C. E. Cunningham R. A. Struchtemeyer, Michael Goven. There was no difference in total yield for potatoes planted 5, 7, and 9 inches apart within the row either with or without irrigation. However, as the spacing decreased, there was a smaller per cent of tubers that were over $2\frac{1}{8}$ inches in diameter, but there was only a slight increase in the per cent of tubers below 2 inches in diameter.

Dip-treatment of the seed potatoes with a 3 per cent solution of thiourea decreased the total yield in all cases, probably because emergence was delayed several days. The decrease in yield was limited largely to tubers above $2\frac{1}{8}$ inches in size. Thiourea treatment also increased the number of stalks per hill markedly and the number of tubers per hill slightly.

Data from these experiments indicate in general that in seasons

* Financial assistance was given this study by the Eastern States Farmers' Exchange.

of optimum growing conditions or with irrigation a considerable percentage of oversize tubers in the crop cannot always be prevented by any presently known practical combination of seed spacing and other treatments. In such years killing the vines when the bulk of the tubers reach the desired size may be the best method of tuber size control, even though some loss in total yield results. Close spacing, thiourea treatment of the seed, use of large cut or whole seed pieces, and certain other treatments aid in the production of high yields of desirable seed-size potatoes.

EFFECT OF STORAGE ON SEED VALUE OF POTATO TUBERS. C. E. Cunningham, W. C. Libby. In an effort to determine the effect of storage temperatures on seed potatoes, three varieties were placed in storage at 36°, 40°, and 50° F., in the fall of 1949. Two weeks before planting, a portion of those tubers held at 36° and 40° F. were placed in the 50° storage. All lots were planted in 1950 under similar conditions for yield comparisons at harvest time.

EFFECT OF NITROGEN RATE AND PLACEMENT AND PREVIOUS CROP ON POTATO YIELDS. G. L. Terman, C. E. Cunningham, Michael Goven. Different rates of nitrogen, in a ton of fertilizer containing 9 per cent phosphoric acid and 9 per cent potash, were applied in row side bands for potatoes. There was very little increase in yield for 150 over 120 pounds of nitrogen per acre, either following potatoes or green manure. A rate of 180 pounds of nitrogen resulted in slightly lower yields in most tests than were obtained with 150 pounds. A rate of 120 pounds gave substantially higher yields than with 90 pounds of nitrogen. Broadcasting 60 pounds of the 150 and 180 pound rates of nitrogen just after planting resulted in similar yields as were obtained by applying all of the fertilizer in row side bands.

The average yield of potatoes following green manure was 605 bushels, as compared to 575 bushels following a crop of potatoes the previous year, an increase of 30 bushels. In 1948 the average increase following green manure was 56 bushels.

EFFECT OF NITROGEN RATE AND PREVIOUS CROP ON THE NITROGEN CONTENT OF POTATO PLANTS.* Harry Trask, G. L. Terman. Tests for nitrate nitrogen in fresh potato rachises from plants grown at Aroostook Farm showed an increase in nitrate content with increase in rates of nitrogen of 90, 120, 150, and 180 pounds per acre. A considerably lower nitrate content was found in plants grown on plots where Japanese millet was turned under for green manure than where potatoes were grown the previous year. Apparently the use of soil nitrates by organisms active in decomposing the millet, which has a high ratio of carbon

* Financial assistance was given this study by the Summers Fertilizer Co.

to nitrogen, resulted in a lower amount of nitrate in the soil and a corresponding lower nitrate content in the potato plants. At another location near Presque Isle, where clover was plowed under as green manure, the nitrate contents of Katahdin potato rachises were higher than on plots cropped to potatoes the previous year. The apparent higher content of nitrate in the soil tends to reflect the lower ratio of carbon to nitrogen in clover, as compared to millet. Potato yields at both locations increased in general with increase of nitrate content in the plants.

EFFECT OF RADIOACTIVITY ON YIELD OF POTATOES. G. I. Terman, Reiner Bonde, J. A. Robinson. A radioactive product called Alphatron, claimed by the manufacturer to stimulate plant growth and proposed for incorporation with potato fertilizers, was used at the rate of 20 pounds per acre in experiments at 2 locations. In 36 paired comparisons of the regular fertilizer mixture with the fertilizer plus Alphatron, there was no average difference in yield of potatoes at either location. This lack of effect of Alphatron in increasing yields is in agreement with the results of numerous experiments conducted with this material in 1948 in several other states.

Alphatron (dust) and Alphatrol (liquid) also were applied with spray and dust fungicides. They did not stimulate plant growth, nor result in increased yields.

WEED CONTROL AND CULTIVATION OF POTATOES. C. E. Cunningham, Harry Trask, James West. Sinox W and a Stoddard Solvent were satisfactory weed control materials when used as pre-emergence applications for potatoes. One-half pound of 2,4-D acid equivalent similarly applied as the sodium salt, however, resulted in marked growth distortion of the potato plants early in the season and slightly lower yields than were obtained on untreated plots.

In a cultivation experiment, 1 or 2 cultivations resulted in markedly greater amounts of sunburn than was obtained with 3 or 4 cultivations. Yields were reduced appreciably by burying the plants by hillng just after emergence. Further work is necessary to determine more definitely the effect of number of times and methods of cultivation on yields.

POTATO VINE KILLING TRIALS. C. E. Cunningham, Michael Goven. In an experiment to determine the effect of maturity of the potato plant on the amount of vascular discoloration resulting from chemical vine killing, Irish Cobblers were planted at dates two weeks apart. These were then killed at three weekly intervals. Date of killing or degree of maturity had no appreciable effect on discoloration. No fading of vascular discoloration was found at intervals of one and two weeks after the vines were killed and after storage for two months.

Rotobeating potato vines, as in 1948, resulted in practically no

vascular discoloration in the tubers. It was again found necessary, however, to apply a vine killer to kill the new growth on the remaining vine stubs.

EFFECT OF SOIL APPLICATION OF ARSENICAL VINE KILLER ON POTATOES AND OATS. G. L. Terman, B. E. Plummer, Jr. Soil applications of sodium arsenite vine killer were made to plots at Presque Isle in the spring of 1949 at rates of 50, 200, and 400 pounds As_2O_3 (arsenic trioxide) per acre. These amounts are approximately equal to the total of normal applications of arsenic in 5, 20, and 40 years for killing potato vines. The 400-pound rate decreased the yield of potatoes more than 100 bushels, as compared to plots to which no arsenic was applied. The 50 and 200-pound rates resulted in smaller decreases in yield. The 400-pound application retarded emergence and reduced the stand of both potatoes and oats.

The translocated content of As_2O_3 in fresh tubers was approximately 0.13 parts per million from plots receiving the 400-pound rate. This is only about one-fifth of the legal tolerance allowed in foods, which indicates that the uptake of arsenic from soil residues by potatoes is not likely to become a health hazard. Considerably larger contents of arsenic in tubers following application of arsenical vine killers have been reported. The content of As_2O_3 in oats grain resulting from the 400-pound application was approximately 0.97 parts per million.

SOIL CONSERVATION EXPERIMENTS. J. W. Slosser,* G. L. Terman, W. C. Libby. After 9 years of continuous operation, soil conservation work on the experimental-demonstration farm was discontinued in the spring of 1950. Experiments on this farm had served their purpose by demonstrating that land made unproductive by severe soil erosion could be brought back rather rapidly to a productive state by proper soil conservation and management practices, and with relatively little increase in the costs of potato production. Soil conservation and better land management practices increased potato yields from 5 to 20 per cent over yields obtained with standard practices. It was also demonstrated that standard equipment could be adapted for satisfactory use in contour, or across-the-slope farming.

Another farm, located between Caribou and Presque Isle, was leased in the spring of 1950 for the purpose of starting new soil conservation and management experiments and for further testing of equipment suitable for conservation farming.

POTATO COMBINE HARVESTER. J. W. Slosser,* W. E. Schrumpf, L. E. Ward. Further trials of the single-row potato harvester in 1949 after further modification demonstrated that mechanical harvesting of

* Cooperative study with Soil Conservation Service, U. S. Dept. Agr.

potatoes on stony land is both feasible and practical. The harvester, with a crew of 2 men and 3 women, harvested in a 9-hour day 495 barrels of potatoes from 3.3 acres. In contrast a conventional single-row digger, with a crew of 7 for digging and picking, harvested an average of only 332 barrels per day. A conventional 2-row digger, with an average crew of 15, harvested 732 barrels per day. These daily rates of harvesting are equivalent to 99 barrels per worker with the combine harvester as compared with 47 barrels for the single-row and 49 barrels for the 2-row conventional diggers. Evidently the combine harvester approximately doubles the efficiency per worker, in terms of the number of barrels harvested.

Total injury of potatoes on a normally stony field dug with the harvester was only 3.7 per cent, which included 1.3 per cent grade damage and 2.4 per cent minor injuries. Comparable total injury of potatoes dug and picked by conventional methods was 11.4 per cent, which was composed of 2.0 per cent grade damage and 9.4 per cent minor injuries. These values indicate a substantial reduction in bruising through use of the combine harvester.

POTATO DIRT REMOVAL. F. W. Peikert, H. D. Bartlett. Equipment for removing field dirt, which inhibits ventilation, gives trouble in operation, and causes excessive wear on modern conveyer handling machinery, was developed and tried. A conventional rubber spool brusher, made to run level and at a slow speed, was compared to the slatted chain conveyer. Limited studies showed equal efficiency for dirt removal, with the rubber roller type having a smaller amount of bruising.

VERTICAL POTATO ELEVATOR. H. D. Bartlett. A machine to elevate potatoes vertically has been designed, built and is being developed. The machine is intended to replace the cleated elevator now in general use for elevating potatoes. It is a more flexible piece of equipment that can be used for elevating potatoes to the top of the building for filling the house, and can be used for bringing potatoes out of the basement storage to the first floor for grading. The machine will require a minimum of space. Further work will be done on the machine to reduce bruising.

RADIANT GLASS HEAT PANEL. H. D. Bartlett. The radiant glass heat panel has been tested at the Aroostook Farm experimental potato storage house as a means of heating potato storages. Present type heating facilities in many potato storages are rather serious fire hazards and have high insurance premium rates. This radiant glass heat panel is compact and should be a safe type of heat, but has a high initial installation and operating cost. No ill effects from the infra-red rays were evident in the potatoes.

RECOVERY OF POTATO STARCH PLANT WASTES.* M. E. Highlands, J. S. Getchell, B. E. Plummer, Jr., J. M. Banton. Work has been continued on the problem of removal of water from the potato pomace which contains 95 per cent water and 5 per cent solids. An intermediate Zenith press has been operated with indifferent success. Under present operating conditions, the press can produce about 500 to 600 pounds of press cake per hour with a 65 per cent moisture content. This production will handle only about half of the waste material produced by the plant where the new equipment has been in operation. Alterations on the press are being considered whereby it is hoped that the press capacity can be materially increased. A Davenport press was tried out last fall at the plant of the Aroostook Potato Products Company. This press functioned very well but the lowest moisture press cake possible to produce on a single press was approximately 71 per cent versus 65 per cent as obtained with the Zenith press.

A satisfactory procedure has been found for drying the press cake, and a ton of dried press cake has been produced. This material will be used in feeding tests with poultry and cattle to determine its value as a feed when combined with other materials such as clover meal, barley, oats, and fish meal.

OPEN AIR FREEZING AND THAWING OF SURPLUS POTATOES. M. E. Highlands, J. S. Getchell, R. H. Treadway.† Various lots of white potatoes were exposed to natural freezing and thawing at Aroostook Farm, Presque Isle, Maine. Potatoes were distributed in varying depths on the ground and on slatted racks. In addition, some were exposed in a vertical slatted crib. A small number were subjected to alternate freezing outside under natural conditions and thawing inside at room temperature.

SHIFTS AND TRENDS IN POTATO PRODUCTION IN THE TWELVE NORTHEASTERN STATES. C. H. Merchant. The statistical information on the acreage and production of potatoes in the twelve Northeastern States before, during, and after World War II has been compiled by states and by counties. The material shows the changes which have taken place in potato production for the past ten years as a result of economic conditions influenced by the Government Price Support Program since the War. The material is being summarized in manuscript form for publication.

EFFECTS OF POTATO ACREAGE ADJUSTMENTS ON MAINE POTATO

* Cooperative study with the Maine Institute of Potato Starch Manufacturers, who provided the necessary building and much of the equipment.

† Cooperative study with Eastern Regional Research Laboratory, U. S. Dept. Agr.

F FARMS. W. E. Schrumpf. Information obtained from 388 potato growers cooperating with the Production and Marketing Administration in Aroostook County shows that the 1949 reduction in potato acreage resulted in a notable increase in the acreage of grain and to a less extent in green manure crops. There was a slight narrowing of the distance between potato rows and a slight shortening of the distance between hills in the rows. The application of seed potatoes was increased 11 per cent and of fertilizer 10 per cent. The acreage of the Katahdin variety was increased from 50.7 per cent of the total acreage of potatoes in 1948 to 53.0 per cent in 1949, but the acreage of the Green Mountain variety was decreased from 29.4 per cent to 25.2 per cent. Livestock per farm was increased from 4.9 animal units in 1948 to 5.4 in 1949. The potential labor force (aside from piece work cutting seed and picking up potatoes) was decreased only 2 per cent. Farm capital investment was nearly the same both years.

STORING, GRADING, AND PACKAGING MAINE POTATOES. C. H. Merchant, W. E. Schrumpf. A manuscript is being prepared on the labor requirements, equipment used, and the amounts of bruising in storing, grading, and packaging Maine potatoes. There is a wide variation in the efficiency of each of these operations as well as wide differences in the amount of bruising occurring to the potatoes.

Information obtained on farm and track storage houses also is being summarized in manuscript form for publication. The material should be helpful to those who plan new storage construction and to those remodeling their present storages. Consideration is given to floor space desirable for various operations such as grading, packaging, storing packaged potatoes and also for washing and drying potatoes.

Through the cooperation of the federal state shipping point office and the State Department of Agriculture information on quality of potatoes shipped from Maine throughout the 1948-49 season has been made available from shipping point inspection certifications. This information enables one to draw comparisons of the quality of potatoes shipped under the Potato Marketing Agreement with the quality of potatoes shipped prior to the marketing agreement. There does not appear to be as large a variation in the various quality factors as might be expected. The data for 1945-47 has been published as Station Bulletin 476, "Grade Quality of Maine Potatoes Inspected at Shipping Points for Three Years, 1945-47," by R. J. A. Bouchard.

MARKETING OF WASHED AND UNWASHED POTATOES. C. H. Merchant, A. L. Perry, F. W. Peikert. Experimental equipment for washing, drying, and grading potatoes in the track storage house at Aroostook Farm has been loaned by the John Bean Division, Food Machinery and

Chemical Corporation of Lansing, Michigan. Gould and Smith of Presque Isle also cooperated through the loan of certain grading equipment. The potatoes were washed with clear well water under 20-30 lbs. pressure through overhead spray nozzles. After the potatoes were passed over several rows of sponge rubber to absorb the free water they then passed through a dryer using forced hot air over and under the potatoes.

The washed potatoes were found to keep as well as the unwashed potatoes under temperature and humidity conditions similar to those found in wholesale warehouses and retail stores. No disease development was detected or any shriveling of the potatoes during the pretesting period using Kennebec, Katahdin, and Green Mountain varieties.

FIGURE 8. The Equipment for Washing and Drying Potatoes in a Consumer Preference Study of Washed and Unwashed Potatoes.

The equipment on the left is the washer, the small unit in the center is an absorber, and the large unit at the right is the dryer. The capacity of the equipment is about two cars of potatoes in a nine-hour day.



Potatoes of each variety were tested for six weeks with examinations by an official inspector weekly.

Washed and unwashed potatoes were offered for sale in the Portland and Orono markets to measure consumer acceptance. During the first two weeks of sale the unwashed potatoes were priced at 39 cents for 10 pounds, and the washed potatoes at 45 cents for a like quantity. During the next two weeks both the washed and unwashed potatoes were priced at 39 cents per package. Although the information on sales has not been completely summarized, the data show that washed potatoes were preferred to unwashed at the same price and also that consumers were willing to pay some premium for washed potatoes. Preliminary information has been obtained as to costs involved in the potato washing and drying operations.

DEVELOPMENT OF DEFECTS IN POTATOES BETWEEN SHIPPING POINTS AND RETAIL STORES.* A. L. Perry. Cuts and bruises were the only types of defects showing any significant development between Maine shipping points and retail stores at Boston. The increase in these types of defects was from an average of 3.53 per cent at shipping points to 10.60 per cent at retail stores. About one-half of this increase occurred between shipping points and wholesale terminals, and the other half between wholesale terminals and retail stores. Also one-half of the overall increase could be attributed to new cuts and bruises occurring in transit and the remaining half to the combined influence of the lapse of time between examinations and to differences in light conditions under which the potatoes were examined. A manuscript is being completed for Station publication.

CHANGES IN THE QUALITY OF POTATOES IN RETAIL STORES.† R. J. A. Bouchard, A. L. Perry. Potatoes were examined by Federal potato inspectors at their arrival at 22 large retail stores in Boston. The lots of potatoes were reexamined again prior to their sale in order to determine the changes in quality that took place while the potatoes were in the retail stores. The information shows that external grade defects increased from an average of 4.58 per cent at their arrival to 7.18 per cent prior to their sale. About 41 per cent of the increase in grade defects was attributed to the handling by store employees and 59 per cent of the increase was due to the time between examinations which permitted the fresh minor bruises at arrival to discolor and develop into grade defects.

* Cooperative Northeast regional study with the cooperation of the Div. Markets of the Maine Dept. Agr., and Prod. and Mkt. Admin. of the U. S. Dept. Agr.

† Cooperative study with the Bur. Agr. Econ., and Prod. and Mkt. Admin. of the U. S. Dept. Agr.

The material is in manuscript form and will be published in the near future.

QUALITY OF FRENCH FRIED POTATOES. G. L. Terman, Michael Goven, C. E. Cunningham.* The Kennebec variety, when stored at 50° F. was satisfactory for French fries made in February, March or April. The Katahdin and Teton varieties, stored at 50°, were of satisfactory color quality in February, but were not as good as the Kennebec in March and April. Green Mountain tubers at 50° were generally of satisfactory quality in February, but not in March or April. The Mohawk potato was generally of unsatisfactory quality in all three months. None of the varieties was satisfactory for French fries when stored at 36° or 40° without reconditioning. However, when the potatoes were reconditioned for 20 or 38 days at 60° or 70°, the sugar content was reduced sufficiently in all varieties for satisfactory French fries.

Specific gravity of potatoes increased appreciably with a longer time in storage, and increased slightly with an increase in size of tubers.

The quality of Katahdin tubers, from vines sprayed with 2, 4, 5-T in August to retard sprouting, was reduced both in regard to sugar content and mealiness.

POULTRY

BREEDING FOR SUPERIOR MEAT QUALITY IN POULTRY. C. E. Howes, J. R. Smyth, R. W. Gerry. This project is an attempt to develop a superior meat type bird without sacrificing egg production, egg size and hatchability. Four generations of Barred Plymouth Rocks and two of Rhode Island Reds have been produced. A gradual improvement has been shown in the development of meat type as measured by weight, body conformation and rate of feathering. Egg production at the end of six months for the 1949 hatch is as good as that of the original stock. Hatchability during the 1950 hatching season averaged over 80 per cent, which is slightly higher than that for the original strain of birds. Egg size has declined slightly, but more attention will be given to selecting for this character in the future.

During the spring of 1950, a total of 390 Barred Plymouth Rock chicks and 423 Rhode Island Red chicks were hatched from these improved selections. In addition 100 chicks each of Barred Plymouth Rocks and Rhode Island Reds hatched from the original strain of birds are being brooded at the same time and in the same brooders for the purpose of determining the progress made to date.

* French frying tests were made by Harold McGowan at the Caribou plant of Birds Eye-Snider Division, General Foods Corporation.

HIGH ENERGY—LOW FIBER RATIONS FOR CHICKENS. R. W. Gerry, J. R. Smyth, C. E. Howes. Two groups of Barred Plymouth Rock females, one fed the New England College Conference high energy starter and broiler ration throughout, and the other fed the NECC conventional starter, grower and layer were carried to 36 weeks of age. The growth, average date of first egg, percentage of egg production, egg size and mortality were similar with both groups. Slightly greater feed efficiency was obtained with the high energy ration during the first 20-week period. During the 20 to 36-week period, the birds fed the high energy ration had a definite saving in feed cost as a result of eating three pounds less feed daily per 100 hens than those fed the conventional laying ration.

In another trial, three lots of sex-linked (Red-Rock) females were fed for 56 weeks. During the first 20-week period the feed efficiency for the birds fed the high energy ration was 4.68 pounds of feed per pound of gain as compared with 4.91 for birds fed a medium-fiber conventional ration, and 5.62 for birds fed a high-fiber conventional ration. Although egg production was approximately the same for the three groups from

FIGURE 9. The Gain in Weight of the Chickens Fed the Different Rations is Checked Every Two Weeks



20-52 weeks, the feed consumption per 100 hens per day for the birds fed the three rations was 24.0 pounds, 27.4 pounds, and 29.4 pounds, respectively. The birds fed the high energy ration averaged about one-fourth pound heavier at the average date of first egg than those fed the conventional ration. Those fed the high-fiber conventional ration came into production about two weeks after the birds on the medium-fiber and high energy rations. Mortality and egg size were not affected by the ration fed.

The rations fed in both of the above experiments were high protein starting rations. It remains to be seen whether good results also can be obtained with laying hens fed lower protein high energy rations.

Another trial involved five lots of sex-linked males. Highest returns over feed cost were obtained with the three lots fed high energy rations. There was little difference between results with the NECC high energy starter and broiler, the original Connecticut Broiler, or the Connecticut Broiler in which the liver meal and vitamin supplements were replaced by a commercial base. The lowest returns over feed cost were obtained with the 1947 NECC starter which contained 12.5 per cent wheat bran and 5 per cent more oats than the present NECC ration. This was due to slower growth as well as poorer feed efficiency.

These feeding trials have further demonstrated the value of high energy rations, in which the problem of mixing the vitamins is solved by the use of commercial bases. Excellent growth and feed efficiency have been obtained. A ration containing only corn, soybean meal, minerals, choline chloride dry premix, and a commercial vitamin base produced growth and feed efficiency equal to the best obtained with more complicated mixtures.

Experiments with Reds, Rocks, and their reciprocal crosses, fed a regular starting ration and a high energy ration, were continued this year.* The results were similar to those obtained a year ago, as reported on page 65 of Bulletin 473.

POTATO STARCH POMACE IN CHICK STARTING RATIONS. R. W. Gerry, J. R. Smyth, C. E. Howes. The general tendency was for feed efficiency to decrease as the amount of pomace in the ration was increased, although there was no pronounced difference when less than 10 per cent of the pomace was used. In the first trial when 0, 6.5, 13, and 25 per cent of dried pomace replaced a combination of corn, oats, and middlings in the New England College Conference ration, the average seven weeks weights per chick were 622, 601, 577, and 478 grams respectively. When corn alone was replaced at the rates of 5, 10, and 15 per cent, the average weights were 634, 605, and 545 grams respectively.

* Financial assistance was given this project by C. M. Cox Company.

When one-half of the middlings was replaced, representing a 10 per cent substitution with pomace, the average seven weeks weight was 597 grams. A 10 per cent replacement for all of the oats resulted in an average weight of 612 grams. In this experiment any ration resulting in an average weight of less than 592 grams was significantly inferior to the NECC basal ration.

In a second experiment, pomace and wheat bran both caused a similar retardation of growth when replacing carbohydrate feeds to the extent of more than 5 per cent. This retardation of growth was much more pronounced with males than with female chicks. The use of wheat bran affected feed efficiency in the same way and to about the same extent as the use of pomace. Thorough cooking of the pomace, however, may make it possible to substitute more of the potato product.

POULTRY HOUSE VENTILATION. H. D. Bartlett, F. W. Peikert, J. R. Smyth, Frank Reed,* B. E. Plummer, Jr. Two broiler houses in Waldo county were selected for a study of ventilation systems for controlling favorable litter and air conditions. These houses, of typical type construction, were newly constructed, two story, uninsulated buildings, housing one bird per square foot of floor area. One house was equipped with a forced ventilation system as recommended by the various ventilating equipment companies. The other house was equipped with gravity flues, with size of opening equal to one square inch per bird, which is considered standard design for the area where the study is being made. Instruments for continuously measuring and recording temperature and humidity were installed in the pens and out of doors to obtain records of outside conditions and corresponding conditions within the pens. The systems were operated by the cooperating farmers.

Several years of study will be required before any definite conclusions can be drawn, but observations made to date may be of interest. Management is a most important factor because both types of ventilation systems require rather careful attention on the part of the operator to make necessary adjustments in the amount of air moved as climatic conditions change. A rather wide range of speed on fans is necessary to take care of varying climatic conditions and regulate the amount of air change for birds of various ages. A lower-limit thermostat control is desirable for shutting off the fan when a desired minimum temperature is reached, thereby preventing undesirable chilling in the house. A too

* Cooperative study with Maine Extension Service

Financial assistance was given this project by Bangor Hydro-Electric Company, Central Maine Power Co., and Maine Public Service Co. Some of the ventilating equipment also was made available without charge by several equipment manufacturers.

rapid change of air in the pens should be avoided since this may cause moisture in the air to condense into the litter if the incoming air is too cold. Where coal burning brooders are used, adequate intakes are necessary with forced ventilation. Otherwise, the reduced pressure resulting within the house will reverse the direction of the draft, and thereby extinguish the fires.

QUALITY OF MARKET EGGS.* C. H. Merchant. Identical eggs were examined at the farms for quality and again at the plants of country buyers during August and November 1948, and again during February and May 1949. Several lots were reexamined after traveling from the country receiving plants to the Boston market.

Preliminary reports issued by the Cornell University Station prepared by Wendell Earl and Lawrence Darrah indicated that the percentage of grade AA eggs was the lowest in August and the highest in November. The five factors most important in explaining differences in quality of eggs between farms were the number of times eggs were gathered daily, whether males were kept in the laying flocks, whether layers were confined, and temperature and humidity conditions in farm storage. The maintenance of egg quality from the farms to the first wholesale receiver depended on the length of time eggs were in transit; the conditions under which they were transported such as temperature, condition of road, and care in driving; and the grading and packaging of the eggs at the farms. Shell damage occurred mostly on collection routes with an increase in damage in relation to number of hours eggs were in transit.

MARKETING EGGS IN RETAIL STORES.† W. E. Savage. Information on consumer preferences and egg quality in retail stores was obtained from 665 retail stores in Maine markets during the summer of 1949. Two-thirds of the retail grocery stores offered only one size of eggs to their customers at the time the store was visited. "Large" eggs was the most common size of eggs offered for sale. Of the eggs examined in these stores, 87 per cent were A grade, 12 per cent B grade and 1 per cent grade C. In the stores selling large grade A eggs the average retail price was 83.4 cents per dozen and the retailers' margin averaged 8.8 cents per dozen.

* Cooperative Northeast regional poultry marketing project, financed primarily by funds from the Research and Marketing Act of 1946.

† Cooperative Northeast regional poultry marketing project under the leadership of Norman Nybroten of West Virginia. The Maine Dept. Agr. cooperated in furnishing inspectors to determine the quality of eggs found in the stores.



Courtesy of Maine Dept. Agr.

FIGURE 10. The Candling of Eggs is Important in Supplying Consumers with Uniformly High Egg Quality.

WHOLESALE EGG PRICES IN NEW ENGLAND.* W. E. Savage. Information was obtained from Maine egg producers as to the prices they received during July, August, and September for eggs sold to retail stores, roadside stands, direct to consumers, and to hatcheries. This information has been checked and forwarded to Mr. Brown of Massachusetts. The information will comprise a part of the report on egg pricing for the Boston market. This study will be completed by Massachusetts during the coming fiscal year.

SHEEP

EARLY VERSUS LATE LAMMING FOR OXFORD EWES. H. C. Dickey. The ewes bred in September on pasture had an average of 1.5 lambs each, while the December-bred ewes that lambed in May had an average

* Cooperative Northeast regional poultry marketing project under the leadership of A. A. Brown of the Mass. Station.

of 1.2 lambs each. The chief problem concerned with early lambing in February is that of raising the young lambs. Because of cold weather in February, the ewes need to lamb in a warm room at 65° F. Even with heat provided, 33 per cent of the early lambs were born dead or died within a few days following birth as compared with 12 per cent for the late lambs. The early-lambing ewes sheared an average of 7.8 pounds of wool while the late-lambing ewes sheared 8.1 pounds.

SOIL TESTING

FARMER TESTING SERVICE. P. N. Carpenter, Agnes Lucas, Marion Harvey. A total of 26,579 soil samples were analyzed as a farmer service during the calendar year of 1949. These samples were analyzed for acidity (pH), readily soluble phosphorus, potassium, calcium and magnesium. On samples from greenhouses, nitrate nitrogen and soluble salt were also determined. A charge of 50 cents was made for each sample tested. Several changes in equipment and technique have improved the efficiency of the laboratory.

PLANT AND SOIL RESEARCH ANALYSIS. P. N. Carpenter, Agnes Lucas, Marion Harvey, Harry Trask. A total of 365 soil samples were analyzed, in connection with research projects, for organic carbon, total nitrogen, exchangeable calcium and potassium, soluble phosphorus, and pH. A total of 2391 plant tissue samples from potato tops, potato tubers, peas, clover, and pea silage were analyzed for total nitrogen, phosphorus, potassium, and calcium.

STRAWBERRIES

STRAWBERRY VARIETY TRIALS. R. M. Bailey, L. E. Littlefield, E. F. Murphy. Temple and Sparkle have been the most promising varieties tested at Highmoor Farm. They are both resistant to red stele, whereas Howard 17 and Catskill are highly susceptible. They have about equaled Howard 17 in productivity during the last three years, and produce berries that are uniform and attractive. They also produce a firmer berry, of higher dessert quality than Howard 17.

In trials at Highmoor, Jonesboro, North Bridgton, Orono, and Van Buren, three numbered selections from Aberdeen x Howard 17, Nos. 55, 81, and 127, appear promising on the basis of red stele resistance, hardiness, productivity, and berry characters. These were superior to Howard 17, Temple and Sparkle in productivity and plant making ability. Fruit firmness and quality were somewhat inferior to Sparkle and Temple, but equal to Howard 17. Production averages for the five trials in quarts per acre were No. 127, 4713; No. 55, 3710; No. 81, 3681; Sparkle, 2473; Howard 17, 2332; and Temple, 1895.

PALATABILITY AND VITAMIN C CONTENT OF STRAWBERRIES. E. F. Murphy, R. M. Bailey. Seedling No. 55 was rated first in palatability after being frozen and stored for 6 months. It was significantly better than Howard 17 and somewhat more acceptable than Sparkle, No. 127, No. 54, and No. 81.

Sparkle, Temple, and Howard 17 (46 to 48 mg. per 100 grams) were higher in vitamin C than were the 4 seedlings which ranged from 35 to 42 mg. per 100 grams. The average values were lower than in 1948.

SUNFLOWERS

SUNFLOWER TRIALS. C. E. Cunningham, C. H. Moran, B. E. Plummer, Jr. For the semi-dwarf type sunflower variety Advance, grown at Aroostook Farm, there was no significant difference in seed yields for the several seed spacings nor was there any yield difference for the fertilizer treatments. The yield of oil per acre for all spacing and fertilizer rates was 420 pounds per acre.

It would appear from the results of the past two seasons that there is little place in Aroostook County for the commercial production of sunflowers for seed, because of the short growing season and the difficulty of drying the seeds to prevent loss from molding.

TOMATOES

TOMATO VARIETY TRIALS. E. F. Murphy, M. Goven, J. H. Waring, Reiner Bonde, Irvin Mason. Six varieties of tomatoes were grown in Jonesboro, and 20 varieties in Presque Isle and Orono to determine adaptability to short season areas. The outstanding early producers were Abel, Chatham, FNC, and FNC x Bounty. The lowest-yielding varieties in all places were Bonny Best, Valiant, Ottawa Hybrid, and N. H. Victor.

NUTRITIVE VALUE OF MAINE TOMATOES. E. F. Murphy. The four varieties with highest vitamin C content, at both Orono and Presque Isle, were High C, Early Trellis, FNC, and FNC x Sioux. Quebec 5 also ranked relatively high in Orono; and FNC x Sioux rated fifth in Presque Isle. The varieties that were lowest in vitamin C in Orono were Danmark, N. H. Victor, Pritchard x Earliana, Bounty, and Valiant; and in Presque Isle were Ottawa Hybrid, Pritchard x Earliana, Danmark, Gloriana, and Redskin. The vitamin C content of the lowest varieties was only one-third to one-half as much as for the highest varieties.

The carotene (vitamin A) content of the 20 Orono-grown tomatoes ranged from 3.29 to 5.06 micrograms per gram. Varietal differences were not significant.

RESISTANCE OF TOMATO VARIETIES TO LATE BLIGHT INFECTION. Reiner Bonde, E. F. Murphy. Two resistant and 3 tolerant varieties were found among 16 cultivated varieties that were tested by inoculation methods. Four out of 11 wild species also were slightly resistant. The F_1 progeny of 2 resistant parents were highly resistant to late blight inoculation.

Of twenty-seven varieties tested for field resistance to natural infection from adjacent diseased potato fields, 4 were resistant in both foliage and fruit, and 8 others were foliage-resistant but fruit-susceptible. Similar field resistance tests were made with wild species and F_1 progeny.

VEGETABLE CROPS

CUCUMBERS. R. M. Bailey, L. Littlefield, Donald Folsom. Selection and the crossing of promising strains were continued to obtain pickling and slicing varieties which are resistant to scab.

FRUIT SET SPRAYS. Lyle Littlefield. The use of fruit set sprays on tomato flowers appeared to induce earlier fruiting and increase early yields.

MISCELLANEOUS VARIETY TRIALS AT HIGHMOOR FARM. Lyle Littlefield. A variety of garden pea called Mayflower (not yet introduced) showed promise as an early, heavy producing, small podded variety. Among 15 varieties and strains of peppers, Pennwonder appeared most promising. Hybrid vigor in eggplants was evident, which may be helpful under Maine conditions. Of several edible soybean varieties, a new variety from the New Hampshire Station, and the variety Sioux were early enough for Maine conditions. Numerous strains and varieties of beans, cucumbers, peas, and watermelons from Asiatic origins were tested, but in most cases they were too late for Maine conditions.

WEED CONTROL IN ONIONS. Lyle Littlefield. Limited tests with a 2 per cent solution of aero cyanate showed no injury to onion sets, and gave a very satisfactory control of weeds.

INSPECTION SERVICE

INSPECTION SERVICE. E. R. Tobey, B. E. Plummer; Jr., M. G. Moore, E. O. Merrill, D. J. Dubé, Judith M. Banton, J. S. Getchell, G. A. Waddell. The Commissioner of Agriculture is the executive of the laws regulating the sale of fertilizers, agricultural seeds, insecticides, fungicides, foods, drugs, and feeding stuffs in Maine. It is the duty of the Director of the Maine Agricultural Experiment Station to analyze or cause to be analyzed the samples collected by the Commissioner and to publish the results of the analyses together with the names of the

persons from whom the samples were obtained and such additional information as may seem advisable. This information is reported in the Official Inspections published during the year. The State Tax Assessor is the executive of the laws regulating the sale of gasoline and motor lubricants. It is the duty of the Director of the Station to analyze or cause to be analyzed the samples collected by the State Tax Assessor but no provision has been made for the publication of the results of the analyses.

A brief summary of the work of inspection is as follows:

Testing of Dairy Glassware. It is required by law that all Babcock glassware used in Maine by creameries, ice cream factories or others buying or selling milk or cream on a basis of the butterfat content, must be tested for accuracy at the Maine Agricultural Experiment Station. A total of 1,746 pieces have been examined during the past year. Three pieces were not passed.

Fertilizer Inspection. A total of 289 samples of fertilizer materials were collected and analyzed. Of these samples, 220 were mixed fertilizers containing nitrogen, phosphoric acid, potash, and in some of the samples, magnesium and borax. The samples of mixed fertilizers represented 163 different brands. Of the total number of samples received, 47 were found to be below guaranty in total nitrogen, 52 in available phosphoric acid, 26 in total phosphoric acid, 33 in soluble potash, 1 in total potash, 3 in total magnesium, and 1 in total calcium.

This year many more samples of different brands of mixed fertilizers were taken than during the last few years. This increased number of analyses gives a much better understanding of the quality of fertilizer sold in Maine and shows that the improvement in the quality of the fertilizer, which was noted last year, has been maintained in 1950.

The results of the analyses are reported in Official Inspections 213.

Fungicides and Insecticides Inspection. A total of 77 official samples, including lead arsenate, mixtures containing arsenic and copper, fungicides containing copper, mixtures containing copper and DDT, insecticides containing DDT, materials containing rotenone, copper and DDT, samples containing chlordane, and unclassified miscellaneous samples, were analyzed.

The use of organic compounds in the manufacture of fungicides and insecticides during the last few years has increased greatly the analytical work in the inspection of these materials. Apparently it is more difficult for manufacturers to meet guaranties in the manufacture of these insecticides. An examination of the results of analyses shows a higher relative number of deficiencies in comparison to guaranties than occurred last

year. This increase, based upon the total number of deficiencies as compared to the total number of samples, is 15 per cent.

The results of the analyses are reported in Official Inspections 214.

Foods and Drugs Inspection. The number and variety of official samples collected and submitted depend upon the nature of the inspection work carried on by the Division of Inspection and the State Dairy Inspector, Augusta, Maine, in the enforcement of the food, drug, and dairy laws.

A total number of 5,055 samples have been received and examined chemically, bacteriologically, or both. Included in this number are 3,837 samples of milk and cream, 68 samples of ice cream and ice cream mix; 60 samples of bread; 27 samples of carbonated beverages; 19 samples of frankfurts and sausage; 68 samples of hamburg; 6 samples of maple syrup; 123 samples of oil used in packing sardines; 55 samples of shellfish; 8 samples of vinegar; 13 samples of lime water; 52 samples of spirit of camphor; 76 samples of spirit of peppermint; and 643 miscellaneous samples. The majority of the miscellaneous samples, consisting of ice cream, ice cream mix, milk, cream, and starch were examined for municipal departments of health, dealers and private individuals.

The results of the inspection yielded the information that approximately 20 per cent of the bread samples were unenriched, that 34 per cent of the samples of hamburg contained sulfite, that 97 per cent of the oil used in packing sardines was soybean oil, and that 27 per cent of the samples of spirit of peppermint exceeded the maximum standard in amount of oil of peppermint.

Considerable improvement over last year was noted in the quality of the samples of milk and cream in standard plate count and the increased number of pasteurized samples. Only 3 samples of milk were found to contain added water.

The results of the analyses will be reported in Official Inspections 215.

Feeding Stuffs Inspection. A total of 715 samples of feeding stuffs were received and the percentages of protein, fat, and fiber in these samples were determined. In general the results of the inspection continue to show improvement in the quality of feeds as indicated by conformity to guaranties.

One official sample of Ground Grain Screenings, manufactured by the McCabe Grain Co., Ltd., Winnipeg, Canada, was received. This sample complied with the guaranties relative to the amounts of protein, fat and fiber but it was found to contain 50 per cent weed seeds and 45 per cent chaff and dirt, which included 7.3 per cent grit.

The results of the analyses will be reported in Official Inspections 216.

Gasoline and Motor Lubricants Inspection. A total of 309 samples of gasoline were received. The results of the analyses indicated that all of these samples complied with the specification of the Maine law regulating the sale of motor gasoline, namely, that the maximum temperature for complete distillation shall not exceed 437° F.

Thirteen of the 74 samples of motor oils, which were examined, failed to meet the manufacturers' specifications for the respective brands asked for by the inspector.

WEATHER

The winter of 1948-49 was characterized as mild and dry. Temperatures were generally above normal, and precipitation was below average. The latter part of April and the first part of May, 1949, were temperate enough to allow land to be cultivated. Orchards were about 10 days in advance of normal, but were damaged to some extent by frosts on May 26. Potato seeding was ahead of schedule, and hay and grass lands were in fine condition. The southern part of Maine became too dry with attendant forest fire danger. During the latter part of May, rainfall was heavy and relieved this serious condition.

The dominating weather features of June, July, and August, 1949 were heat and drouth. In all sections of the State, temperatures averaged 2 to 9 degrees above normal during the 3 summer months. Periods of extreme heat and parching winds dried vegetation. Rainfall was deficient throughout the entire season in southern (1.16 to 2.49 inches below normal) and central (.08 to 2.39 inches below normal) Maine. The hay crop rapidly deteriorated and small fruit crops and vegetables were adversely affected. Several times the forests became dangerously dry, and many fires were controlled only by vigilance and efficient organization. Domestic water supplies became critically low. In Northern Maine, temperatures were above normal, but rainfall was adequate and well distributed throughout much of the growing season. Potato crops responded to favorable weather with high yields.

September, which was cooler than normal with sufficient rainfall, brought light local frosts on the 10th, affecting the tender crops. A general freeze on the 26th practically ended the growing season in most sections. Rains were adequate to revive grass and forest lands, but not to replenish scarce water supplies. Unseasonably warm weather occurred during October and the first half of November. Water deficiency was still acute in many sections although adequate rainfall came in November. Late November and December were seasonably cold, but the year ended

with high temperatures which brought the December average from 3° to 11° above normal throughout the State. Less than normal rainfall was beneficially absorbed into the unfrozen ground.

Weather information is obtained by the Station staff at its three farms in Jonesboro, Monmouth, and Presque Isle; and by the Physics Department, University of Maine, at Orono. The data for each of these Stations, except at Monmouth, are published monthly by the United States Weather Bureau in Climatological Data for New England. The information for Highmoor Farm at Monmouth is summarized below:

Month	Temperature			Total inches Precipitation	No. of days with .01 inch or more Precipitation
	Average	Max.	Min.		
July '49	70.5	96	47	1.04	5
Aug.	68.6	95	46	1.71	9
Sept.	57.3	81	33	4.18	14
Oct.	50.4	81	25	2.38	12
Nov.	33.3	59	7	4.75	16
Dec.	27.5	53	0	1.76	10
Jan. '50	23.8	63	-12	4.13	17
Feb.	15.8	42	-13	2.32	14
March	24.6	60	-10	4.41	11
April	40.4	64	20	3.03	15
May	53.8	82	25	1.19	8
June	63.8	90	39	4.09	8

PUBLICATIONS

The publications issued during the year 1949-50 comprise 10 Experiment Station Bulletins, 3 Miscellaneous Publications printed in bulletin form, 4 Official Inspections, and 6 Mimeographed Reports prepared for limited distribution by the author.

One copy of any of the printed publications may be obtained, without charge, upon request to the Agricultural Experiment Station at Orono, Maine. A card listing the new available publications is mailed at least annually to those who request having their names placed on the mailing list for this purpose. A complete list of all bulletins now available also can be obtained upon request.

In addition to the publications issued by the Station Staff, a total of 9 articles were published during the year in scientific journals, 29 articles were included in agricultural magazines, and numerous news releases were printed in the newspapers. The research workers also have cooperated in preparing publications issued by the Extension Service.

Members of the Station Staff have discussed the results of their research work at a number of meetings, including 15 papers at scientific meetings, 10 radio talks, and 119 talks to other farm groups. The research workers also have given assistance to many farmers through

correspondence and interviews in the identification of insects and diseases and in solving other current problems.

The following is a list of publications issued during 1949-50.

EXPERIMENT STATION BULLETINS:

- No. 474. Green Manure Crops and Rotations for Maine Potato Soils. G. L. Terman. July, 1949. 40 pages.
- No. 475. Remodeling the School Lunch for the Teen-Ager. Mary M. Clayton and Dorothy E. Ullman. August, 1949. 24 pages.
- No. 476. Grade Quality of Maine Potatoes Inspected at Shipping Points for Three Years, 1945-47. Roland J. A. Bouchard. November, 1949. 31 pages.
- No. 477. Consumer Use of Dairy Products in Portland, Maine. H. Alan Luke. November, 1949. 47 pages.
- No. 478. Quality of Maine McIntosh Apples from Orchards to Consumers. Homer C. Woodward. December, 1949. 36 pages.
- No. 479. Producing Blueberries in Maine. G. F. Dow, M. T. Hilborn, M. F. Trevett, I. C. Mason, F. P. Eggert, F. H. Lathrop, M. E. Highlands. March, 1950. 42 pages.
- No. 480. Control of Aphids on Potatoes With DDT When Used With Fungicides. W. A. Shands, G. W. Simpson, P. M. Lombard, R. M. Cobb, P. H. Lung. May, 1950.
- No. 481. Effect of Rate and Source of Potash on Yield and Starch Content of Potatoes. G. L. Terman. May, 1950.
- No. 482. Factors Affecting Potato Blackleg and Seed-Piece Decay. Reiner Bonde. May, 1950.
- No. 483. Agricultural Research in Maine, Sixty-Sixth Annual Report of Progress, Year Ending June 30, 1950. June, 1950.

OFFICIAL INSPECTIONS:

- No. 212. Commercial Feeding Stuffs, 1948-49. Elmer R. Tobey. July, 1949. 35 pages.
- No. 213. Commercial Fertilizers, 1949. Elmer R. Tobey. October, 1949. 32 pages.
- No. 214. Fungicides and Insecticides, 1949. Elmer R. Tobey. December, 1949. 12 pages.
- No. 215. Foods and Drugs. Elmer R. Tobey. June, 1950.

MISCELLANEOUS PUBLICATIONS:

- No. 616. Thirty Minutes With the Maine Agricultural Experiment Station. November, 1949. 27 pages.
- No. 617. Marketing of Hatching Eggs in Maine (Preliminary Report). Andrew E. Watson. September, 1949. 34 pages.
- No. 618. Pest Control Materials, 1950. D. E. H. Frear and M. T. Hilborn. Also issued as Northeast Regional Publication No. 2, and as Pennsylvania Agricultural Experiment Station Progress Report No. 20. 148 pages.

MIMEOGRAPHED REPORTS: (for limited distribution by research departments) :

- No. 6. A Guide For the Use of Chemical Weed Killers. M. F. Trevett. January, 1950. 12 pages.
- No. 7. Residues of Arsenic and of Copper on Blueberries. F. H. Lathrop. January, 1950.
- No. 8. Cooperative Potato Variety Trials in 1949. R. V. Akeley and W. C. Libby. February, 1950. 4 pages.
- No. 9. Use of Fertilizer for Maine Blueberries. M. F. Trevett. February, 1950. 11 pages.
- No. 10. Cooperative Small Grain Trials in Maine, 1949. S. C. Junkins. March, 1950. 4 pages.
- No. 11. Maine Snap Beans, Sweet Corn, and Green Peas for Processing. W. E. Schrumpf. March, 1950. 39 pages.
- . Changes in Costs of Milk Distribution in Maine, 1946 to 1949. Brief presented at public hearing of Maine Milk Commission, March 15, 1950. George F. Dow. 9 pages.

ARTICLES IN SCIENTIFIC JOURNALS:

Bonde, Reiner, and Mildred Covell. Effect of Host Variety and Other Factors on Pathogenicity of Potato Ring-Rot Bacteria. *Phytopath.* 39:161-172. 1949.

Bonde, Reiner. Resistance to Ring Rot, 1949. The National Potato-Breeding Program. March, 1950.

Hilborn, M. T. and F. H. Lathrop. Organic Fungicides in the Control of Apple Scab and European Red Mite Control. *Phytopathology* (Accepted for publication 1950).

Hilborn, M. T. Some Aspects of Apple Scab Control in Maine. *Proceedings New Hampshire Horticulture Society* 1950.

Lathrop, F. H. and M. T. Hilborn. European Red Mite Control. *Journal Econ. Entomology.* 43:172-175. 1950.

Libby, W. C. Variety Testing and Release in Maine. *American Potato Journal,* 26:404-409. 1950.

Peikert, F. W. A Comparison of Tillage Implements Based on Research Results. *Journal American Society Agr. Engineers*, May 1950.

Simpson, G. W. and Reiner Bonde. Leafroll Resistant Seedlings. The National Potato-Breeding Program, March, 1950.

Terman, G. L. Effect of Source of Potash in The Fertilizer on Yield and Starch Content of Potatoes. *American Potato Journal,* 26:291-298. 1949.

FINANCIAL REPORT

The total income of the Station during the year ending June 30, 1950 was \$482,589.22. The sources of income were 38.2 per cent from federal funds, 20.3 per cent from the State Mill Tax, 18.0 per cent from the industry taxes on potatoes and blueberries, 11.6 per cent from service work on inspection analysis and Florida potato tests, 2.4 per cent from special research grants, and 9.5 per cent from the sale of farm products, soil testing, and miscellaneous.

The income received was \$6,863.73 less than the total for the previous year, in spite of an increase of \$25,722.66 from the Research and Marketing Act of 1946, and some additional funds from the potato and blueberry taxes. Decreased income resulted from a considerable drop in the value of farm products sold, and a slight reduction in other funds such as the State Mill Tax, and special research grants.

The slightly greater amount of expenses above current income was met by a small carry-over of certain funds from the previous year.

**Summary of Income and Expenditures of
The Maine Agricultural Experiment Station
July 1, 1949 to June 30, 1950**

Source of funds	Total income	Per cent of income	Total expenses
Hatch Act	\$ 15,000.00	3.1	\$ 15,000.00
Adams Act	15,000.00	3.1	15,000.00
Purnell Act	60,000.00	12.5	60,000.00
Bankhead-Jones Act	24,124.05	5.0	24,124.05
Research and Marketing Act	70,079.00	14.5	70,246.92
 Total federal funds	 \$184,203.05	 38.2	 \$184,370.97
State Mill Tax	\$ 97,944.39	20.3	\$102,220.12
Potato Tax	59,097.42	12.2	59,097.42
Blueberry Tax and Farm Sales	28,041.75	5.8	18,461.67
Inspection Analysis	27,321.40	5.7	27,321.40
Florida Potato test	28,274.84	5.9	31,432.04
Sales and Service*	45,891.25	9.5	52,463.95
Special Research Grants†	11,815.12	2.4	16,395.61
 Total all funds	 \$482,589.22	 100.0	 \$491,763.18

* Includes soil testing, grain testing, and income from farm products sold other than blueberries.

† Additional special research grants were received during the year from:

Sweet Corn Tax Receipts, through the Maine Department of Agriculture, for corn borer research.

Fertilizer Industry Committee on Radioactive Tracer Elements for study on utilization of phosphorus.

Maine Sea and Shore Fisheries, through the Maine Development Commission, for lobster study.

General Chemical Company for potato spraying and dusting experiments.

Bangor Hydro-Electric Company, Central Maine Power Company, and Maine Public Service Company for poultry house ventilation study.

Tennessee Corporation for potato fungicide tests.